American Journal of Obstetrics and Gynecology

VOL. 51 MAY, 1946 No. 5

Original Communications

AN INQUIRY INTO THE CAUSES OF BREECH PRESENTATION

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IN 1940 C. Keith Vartan published a short but provocative paper on the etiology of breech presentation. He introduced his subject by reviewing the causes of breech presentation listed in current textbooks; namely, prematurity, placenta previa, hydrocephalus, multiparity, multiple pregnancy, contracted pelvis, and pelvic tumors. Then he said, "What struck me and still impresses me concerning the etiology of breech presentation is that most of these factors which are reputed to be causes seldom occur. I concluded, therefore, that either the 'cause' is so rare as to be almost a chance coincidence or that the cause in almost every case is unknown." He presented data derived from 969 breech cases to support this conclusion.

The present study of the etiology of breech presentations is a repetition and elaboration of Vartan's work.* At the Philadelphia Lying-In Hospital in the ten years following Jan. 1, 1933, there were 1,184 breeches among 25,170 deliveries. Excluding breech deliveries after internal podalic version and excluding all twins presenting by the breech, there remain 911 single "primary" breech presentations delivered normally or by cesarean section. In the analysis to follow, each of the factors usually alleged to cause breech presentation will be critically examined in the light of these 911 case histories.

1. *Multiple pregnancy* is not dealt with in the study proper since the inclusion of twins, triplets, and quadruplets would confuse rather than clarify an understanding of the mechanism of breech lies. However, it may be said in passing that common sense leads one to expect twins to lie in utero in a head-to-breech position, each facing medially with relation to the mother. It is as natural a fit as a pair of shoes in a shoe box lying heel-to-toe, soles out, soft sides in. Multiple pregnancy undoubtedly disposes to the breech presentation of one baby.

*Since the present study was submitted to the editor, Dr. Varten has published a continuation of his own work (J. Obst. & Gynaec. Brit. Emp. 52: 417, 1945). In this second article Varten uses a different approach from the author, but arrives at similar conclusions.

NOTE: The Editors accept no responsibility for the views and statements of authors as published in their "Original Communications."

2. *Prematurity* is an important factor in breech presentation. To be more specific, small babies, regardless of the period of gestation, are more likely to present or to be delivered as breeches. It is a fact which anyone may easily verify, and which Weisman has proved by x-ray studies, that breeches are common until the last month or so of pregnancy and that spontaneous conversion to a cephalic presentation is the rule as term approaches. Hence, if one is to determine the mechanism producing breeches at term, it is essential to separate the premature or small babies arbitrarily from the mature. Reference to Table I will show that the incidence of breeches is greatest among infants weighing less than 2,500 grams (5½ pounds) at birth, and since this weight is commonly accepted as the dividing line between prematurity and maturity, most of this study will be concerned with single pregnancies terminating in a breech baby weighing 2,500 or more grams.

It is apparent that the proportion of breeches in any hospital series will increase if smaller babies are included (Table II). This probably explains the varying incidence of breeches in different clinics.

TABLE I. SHOWING THE INCIDENCE OF BREECH PRESENTATION IN RELATION TO FETAL WEIGHT IN 4,138 DELIVERIES OF SINGLE BABIES

GRAMS	UNDER 1,000	1,000-1,499	1,500-1,999	2,000-2,499	2,500-2,999	3,000-3,499	3,500-3,999	OVER 4,000	TOTALS
Breech presentations	15	12	8	13	26	60	19	8	161
All presentations	59	34	46	165	736	1,659	1,104	335	4,138
Per cent breech	25	35	17	8	3.5	3.6	1.7	2.4	3.9

TABLE II. SHOWING HOW THE INCIDENCE OF BREECH PRESENTATIONS INCREASES IF SMALLER FETUSES ARE INCLUDED IN THE SERIES (DERIVED FROM TABLE I)

GRAMS	ALL WEIGHTS	1,000 OR MORE	1,500 OR MORE	2,000 OR MORE	2,500 OR MORE	3,000 OR MORE	3,500 OR MORE	4,000 OR MORE
Breech presentations	161	146	134	126	113	87	27	8
All presentations	4,138	4,079	4,045	3,999	3,834	3,098	1,439	335
Per cent breech	3.9	3.6	3.3	3.1	2.9	2.8	1.9	2.4

Whether breeches tend to produce premature labor, or vice versa, will not be questioned here. The fact is that small babies, as well as twins, are often breech at birth. The more interesting question is, why do some mature infants present as breeches?

3. *Multiparity* is a stated cause of breeches. The relation is difficult to determine, for as parity increases, age increases, the average size of babies increases, and other confusing factors enter the problem. As a preliminary study of the effect of multiparity, the incidence of breeches was determined in 1,000 consecutive primiparas, 1,000 consecutive secundiparas, and so on. The original project of securing data for 1,000 patients in each rank of parity could not be completed, but the figures from 5,262 histories are displayed in Table III. After studying them and considering all the possible concomitant factors, the reader will probably not be particularly impressed with the importance of multiparity as a cause of breech presentations.

It is said in support of the contention that multiparity predisposes to breeches that more than 50 per cent of breeches occur in multiparas. This is easy to believe since 51 per cent of all patients in our clinic are multiparas (Table IV). Yet oddly enough, 55 per cent of all breeches over 2,500 grams were born to primiparas. Calculations of this sort are frequently made and sometimes quoted but upon reflection have little to do with solving the relation between multiparity and breeches.

Nandi strikes nearer the root of the problem when he points out that if the incidence of breeches is 3 per cent in the first pregnancy and 3 per cent in each subsequent preg-

TABLE III. SHOWING THE INCIDENCE OF BREECH PRESENTATION IN RELATION TO PARITY IN 5,262 DELIVERIES OF SINGLE BABIES

	ALL BABIES				BABIES OVER 2,500 GRAMS			
PARITY	NUMBER OF DELIVERIES	BREECHES NUMBER	BREECHES PER CENT		NUMBER OF DELIVERIES	BREECHES NUMBER	BREECHES PER CENT	
1	1,000	44	4.4		913	31	3.4	
2	1,000	31	3.1	3.7	914	19	2.1	3.0
3	1,000	38	3.8		893	32	3.6	
4	1,000	35	3.5		546*	12	2.2	
5	500	24	4.8		243	6	2.5	
6	300	16	5.3		140	5	3.6	
7	156	5	3.2		67	0	0.0	
8	125	7	5.9	4.4	55	2	3.6	2.8
9	81	4	4.9		24	2	8.0	
10	51	2	3.9		20	2	10.0	
11 or more	49	8	16.0		17	2	12.0	
Total	5,262	214	4.07		3,832	113	2.95	

These figures were derived from a chronological list of deliveries in the following way: Data for fetal presentation and weight were recorded on every case, regardless of parity, until 1,000 para i patients had been tabulated; thereafter data were recorded for all patients except para i, until a total of 1,000 para ii patients had been tabulated; thereafter para i and ii were omitted and the tabulation was continued until data accumulated for 1,000 para iii, and so on. The original plan was to secure data for 1,000 patients in each rank of parity. This project was abandoned after 5,262 patients were listed, because of the realization that a clinic which records its data on punch-cards could, with the use of business machines, tabulate an enormous mass of data of this sort in a few hours. To complete even a small series of 10,000 cases by hand-sorting would have required additional weeks.

(*Reference to the table shows that about 90 per cent of babies born to paras i, ii, and iii weighed over 2,500 grams. A smaller percentage of babies born to patients of higher parity are listed as weighing over 2,500 grams because tabulation of fetal weights was discontinued.)

TABLE IV. COMPARING THE PARITY OF MOTHERS HAVING BREECH PRESENTATIONS WITH THE PARITY OF THE GENERAL POPULATION OF THE HOSPITAL

MOTHER'S PARITY	1	2	3	4	5	6	7 OR MORE	PER CENT	NUMBER OF PATIENTS
All presentations	49%	34%	10%	3%	2%	1%	1%	100	2,051*
All breeches	54%	21%	12%	4%	3%	2%	4%	100	910†
Breeches over 2,500 grams	55%	21%	11%	4%	2%	3%	4%	100	677

*A chronological series of deliveries.

†911 breeches in present study (parity not stated for one patient).

TABLE V. SHOWING THE INCIDENCE OF BREECHES IN THE SECOND PREGNANCY OF 127 PATIENTS WHOSE FIRST BABY WAS BREECH (GROUP A). TWO CONTROL SERIES ARE PRESENTED (GROUPS B AND C). GROUPS A AND B ARE LIMITED TO PATIENTS WHO HAD TWO BABIES EACH WEIGHING OVER 2,500 GRAMS. GROUP C IS LIMITED TO PATIENTS WHOSE SECOND BABY WEIGHED OVER 2,500 GRAMS

GROUP	SOURCE OF DATA	BREECH PRESENTATIONS PARA I	BREECH PRESENTATIONS PARA II
A	127 patients para ii whose first baby was a breech (taken from the general population of the hospital)	127 (100%)	12 (9.4%)
B	127 patients para ii whose first baby was a cephalic (taken from histories of author's private patients)	None (0%)	3 (2.4%)
C	914 patients, para ii (data from Table III, a sample of the general population of the hospital)	No data	19 (2.1%)

If this table is a reliable guide, it appears that a mother whose first baby is breech has a greater than average chance of having a breech with her second pregnancy provided that both babies weigh over 2,500 grams.

TABLE VI. PRESENTING DATA RELATING TO THE PROBABILITY OF MORE THAN ONE BREECH BIRTH OCCURRING DURING THE LIFETIME OF A MULTIPAROUS PATIENT

1,300	409 mothers bore at least one breech baby over 2,500 grams and at least one other baby over 2,500 grams. Excluding twins these women bore a total of 1,300 infants
−409	Subtracting one breech baby for each mother, we are left with 891
891	births in addition to one breech birth
−598	598 babies are excluded because they weighed less than 2,500 grams or because data are not available (born elsewhere)
293 (100%)	Babies over 2,500 grams remain
267 (91.1%)	Cephalic presentations
26 (8.9%)	Breech presentations

If the chance of a breech birth (for infants over 2,500 grams) be taken as 3 per cent, this tabulation makes it appear that a mother who has once borne a breech baby has a greater than average chance of another breech presentation if additional children are born.

nancy, it follows that women who have the largest number of children will ultimately have the greatest number of breeches. To put it another way: the more often one flips a coin the greater the chance of eventually getting "tails."

Although the effect of multiparity in predisposing to breeches cannot be solved from the data on the series presented here, some related problems can be studied. For instance, do breeches tend to be repeated in the same individual? Table V shows that breeches recurred in secundiparas more often than anticipated. But the series is too small to justify conclusions. Table VI attempts to answer the question whether breeches tend to recur in the same mother regardless of her parity at the time of any breech birth and regardless of the total number of children she bears. This involved question requires for solution a mass of information difficult to assemble. Our own data are incomplete but they seem to show that mothers who bear one breech baby have, among their other babies, an incidence of breech births which is higher than the breech incidence for the hospital as a whole. Thus it appears that some patients have an individual tendency to bear breech babies.

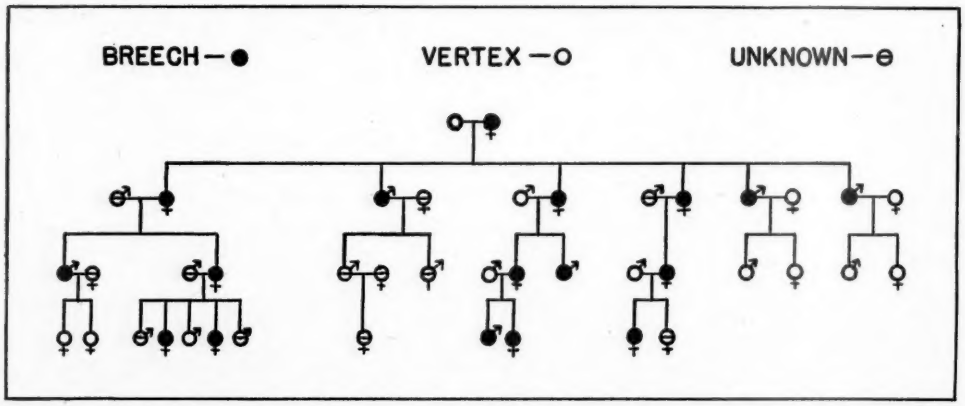

Fig. 1.—(Redrawn from Cartledge and Hancock.) The second generation consists of three sons and three daughters, all breech births. Note that every subsequent breech birth occurred in the offspring of the daughters.

4. *Hereditary tendency to breech* might seem in the domain of folklore were it not for the report of Cartledge and Hancock whose diagram is reproduced in Fig. 1. The recurrence of breeches in this family is greater than chance (calculated at 3 per cent) would account for.

5. *Contracted pelvis* is an old explanation for breech presentations and not a very sound one. To begin with, pelvic contraction is extremely difficult to define, especially in the case of breeches. In collecting data from our own records the writer accepted the state-

ment that the patient had a contracted pelvis. No attempt was made to verify, correct, or justify the criteria in vogue when the record was made. Hence "contracted pelvis" is used in this paragraph in the loosest possible sense and includes pelves described as flat, android, asymmetric, platypelloid, justo minor, rachitic, and funnel. Among mothers bearing 677 mature breech babies there were 75 "contracted pelves," or 11 per cent. Phrased otherwise, this means that of all the breech deliveries observed 89 per cent could not be attributed to contracted pelvis. Therefore pelvic shape is not a striking factor in the etiology of breeches. If it were, one would find that multiparous patients with pelvic contractions had a high incidence of repeated breech presentations. Apparently they do not. (Table VII.)

TABLE VII. SHOWING THE INCIDENCE OF "CONTRACTED PELVIS" AMONG MOTHERS BEARING BREECH INFANTS AND THE INCIDENCE OF REPEATED BREECH BIRTHS IN MOTHERS WITH "CONTRACTED PELVIS" (ALL DATA LIMITED TO BABIES OVER 2,500 GRAMS)

Total number of breech babies	677	100%
Number of breech births associated with "contracted pelvis"	75	11%
Number of mothers with "contracted pelvis" bearing babies of known polarity in addition to one breech baby	22	
Total number of babies born to these 22 mothers	52	
Subtracting 1 breech baby for each mother	22	
There remain 30 additional babies	30	100%
Of these 3 were breeches (2 normal babies and 1 dead for one month before delivery)	3	10%

Tables V and VI show that breech births are repeated in about 9 per cent of all multiparas. If "contracted pelvis," as defined in the text, plays a part in causing breech presentations, we should expect to find a remarkably high incidence of breeches among multiparas with contracted pelves. On the contrary, we find in the table above that multiparas with contracted pelves have only a 10 per cent incidence of repeated breech births. Accordingly, these tabulations do not support the idea that presentations are influenced by the structure of the maternal pelvis.

TABLE VIII. SHOWING THE INCIDENCE OF BREECH PRESENTATION AMONG 231 HYDROCEPHALIC INFANTS (WHETHER INTERNAL OR EXTERNAL HYDROCEPHALUS NOT SPECIFIED) AND AMONG 197 ANENCEPHALIC INFANTS (COURTESY OF DR. RAYMOND L. YOUNG)

	GRAMS	UNDER 500	500 999	1,000 1,499	1,500 1,999	2,000 2,499	2,500 2,999	3,000 3,499	3,500 3,999	4,000 4,499	OVER 4,500	ALL WEIGHTS	2,500 AND OVER
Hydrocephalics	Cephalic	1	4	5	12	30	36	43	27	10	1	169	117
	Breech	0	3	2	5	10	11	17	6	3	5	62	42
	Total	1	7	7	17	40	47	60	33	13	6	231	159
	Per cent Breech											27	26
Anencephalics	Cephalic	1	25	41	36	15	22	15	5	2	0	162	44
	Breech	2	5	9	5	4	3	6	1	0	0	35	10
	Total	3	30	50	41	19	25	21	6	2	0	197	54
	Per cent Breech											18	19

6. *Gross fetal abnormalities* are often associated with breeches. Through the kindness of Dr. Raymond L. Young I am permitted to display data which he collected in collaboration with Dr. Edith Potter of the Chicago Lying-in Hospital. The data were derived from autopsies on 1,705 malformed fetuses and infants. We see in Table VIII that 26 per cent of hydrocephalics and 18 per cent of anencephalics weighing over 2,500 grams delivered as breeches. So these fetal abnormalities predispose in some way, and perhaps not in the obvious way, to breech presentation. However, neither hydrocephalus, anencephalus, nor other gross abnormalities play a very great part in producing breech lies in a large series of breeches. Among 677 breech babies over 2,500 grams in our series, there were only 7 hydrocephalics and 2 anencephalics. There were also two infants with large abdominal tumors due to polycystic kidneys.

7. *Placenta previa* is another stated factor in breech births. Only 8 cases of placenta previa were recorded in 677 breech births.

8. *Pelvic tumors* are reputed to cause breech presentation. Possibly all the pelvic tumors which occurred were not revealed by the present survey. Be that as it may, only 4 were mentioned in the 677 histories. Even if it is admitted that these tumors caused the breech lie, they account for only 0.6 per cent of all the breeches observed. And if the actual number of pelvic tumors was several times as great as the recorded number, these tumors still could account for an insignificant percentage of breech births.

9. *A uterine anomaly,* particularly bicornate uterus, is often associated with faulty presentation. In 35 cases of pregnancy in anomalous uteri, Smith found 15 breeches and 6 transverse lies. Rosenbloom's patient with a bicornate uterus had 2 breech and 2 transverse presentations in 7 term pregnancies. But incomplete fusion of the Müllerian ducts is rare; Smith estimates the incidence at one in 1,500 obstetric patients. Four cases were observed in the present series of 677 breeches, and in addition there was one case of septate vagina which may have been accompanied by a divided uterus.

10. *Uterine scars:* The influence of a uterine scar on breech presentations was considered. An examination was made of 100 records chosen at random of patients who had two cesarean sections. Only one patient had a breech lie when the second cesarean was performed.

11. *Maternal obesity* is alleged to increase the incidence of breeches. No statistics are available for our patients. However, Odell and Mengert report 5.5 per cent breeches (over 1,500 grams) among 687 deliveries of patients weighing 200 or more pounds. This percentage probably includes twins, and babies delivered after internal podalic version. If so, the incidence of breeches among obese patients is not remarkably high.

12. *Maternal age* is said to be a factor in breeches. If the question is to be fairly examined, any effect of multiparity upon the incidence of breeches must be eliminated. Therefore, data from elderly primiparas only will be considered. The incidence of breeches in primiparas of 35 years and over in this clinic is 9 per cent (Roeder, 113 patients). The data are not divided according to fetal weight so it may be presumed that the percentage includes infants of all weights. It seems not improbable that older primiparas have a somewhat greater tendency to breech presentations.

13. *Polyhydramnios* is reputed to be responsible for breeches, probably on the theory that the distended uterus offers more opportunity for spontaneous version or that there is less effective application of forces tending to press the fetus into the pelvis. Hydramnios is an elusive subject; as in the case of contracted pelvis, the first problem is definition. Polyhydramnios means excessive fluid, but how much is excessive? An amount which would be quite normal for a woman carrying a large baby might be decidedly excessive if the baby were small. So the relation of polyhydramnios to breech presentation depends not so much upon the measurable volume of fluid but upon the relation between the volume of the fluid and the volume of the baby. Measurements of this sort are not available in the present series of cases. Furthermore, polyhydramnios is so often associated with fetal malformation that it would be difficult to determine which factor, excessive fluid or malformation, was primarily responsible for the presentation.

At this point we may pause to evaluate the total effect of the factors which have thus far been considered as possible causes of breech presentations:

Multiple pregnancy	admittedly a factor
Prematurity	admittedly a factor
Multiparity	a doubtful factor
Hereditary tendency	possibly a factor
Uterine scars	probably not a factor
Obesity	probably not a factor
Elderly primiparas	possibly a factor
Polyhydramnios	possibly a factor

The more commonly accepted etiological influences are listed in Table IX. It is unlikely that many pelves are sufficiently contracted to effect the presen-

tation of very small babies, yet the incidence of "contracted pelvis" is about the same among mothers of babies weighing 210 to 2,499 grams as it is among mothers of mature babies. This observation further weakens the argument that pelvic architecture plays an important part in determining the presentation. Be that as it may, by invoking all the causes for breech presentation which seem to have a calculable importance, we have accounted for only 15 per cent of breech births of mature single babies. (Table IX.) Therefore, it

TABLE IX. SHOWING THAT THE CLASSICAL EXPLANATIONS FOR BREECH PRESENTATION ACCOUNT FOR ONLY 15 PER CENT OF BREECHES OBSERVED

	BABIES OVER 2,500 GRAMS		BABIES UNDER 2,500 GRAMS	
	(NO.)	(%)	(NO.)	(%)
"Contracted pelvis"	75	11.1	24	10.2
Gross fetal anomalies	11	1.6	10	4.3
Placenta previa	8	1.2	9	3.9
Pelvic tumors	4	0.6	1	0.4
Uterine anomalies	4	0.6	2	0.8
No demonstrable factor	575	84.9	188	80.3
Totals	677	100.0	234	100.0

is clear that factors other than those classically recognized must be at work. An attempt will now be made to discover these unrecognized factors.

14. *Fetal activity* is seldom mentioned in the etiology of presentation. However, if a clinician purposefully inquires about the degree of fetal activity at each antepartum visit, he will note that when relative inactivity is reported the baby is often found in a breech presentation. Whether fetal activity decreases before or after the baby assumes the breech presentation has not been determined. Also, we often find that babies which are languid after birth, for example some hydrocephalics, were delivered as breeches. Many of these are described as "inactive" babies before birth. In this connection two of my own cases come to mind. Both were breech babies with large lumbar meningoceles, both had motor paralysis of the lower extremities and died some days after delivery. One cannot avoid the thought that inability to move the legs contributed to their breech presentations. Going further, we realize that babies which die in utero weeks before birth not uncommonly are delivered as breeches. It is reasonable to believe that maimed babies who have impaired powers of motion, and babies whose movement is limited by extension of the legs would have less chance of extricating themselves from a breech lie by their own efforts than vigorous babies with flexed legs.

15. *Extended legs* (frank breeches) have long been recognized as the commonest type of the breech presentation. It has also been realized that external cephalic version of breech babies is difficult when the legs are extended, probably because of the "splinting" effect of the legs. After considering these facts, Vartan developed the idea that extension of the legs might be the primary cause of breech presentations. His data are compared with our own in Table X. By this method of tabulation some 60 per cent of breeches are explained, whereas the "classical factors" account for only 15 per cent of all the cases observed (Table IX). The suggestion that extended legs cause breech presentations is appealing but requires examination.

To begin with, a comparison was made between the incidence of extended legs in breech and cephalic presentations at term. At least 62 per cent of breech babies in this series had extended legs when they were delivered (Table XII). The percentage is probably higher, for some babies were delivered as "half-frank" presentations; in our records these were usually designated simply as footlings. To determine the incidence of extended legs in cephalic presentations the writer reviewed a random group of x-ray films taken at or near term (Table XI). There is no reason to believe that any unsuspected "selection" in this group of films effects the percentage of extended and flexed legs observed.

TABLE X. COMPARING TWO SERIES IN WHICH THE ETIOLOGICAL FACTORS ARE SET FORTH IN ACCORDANCE WITH VARTAN'S EMPHASIS ON THE IMPORTANCE OF EXTENDED LEGS

ORDER	VARTAN'S SERIES OF 969 BREECHES MINUS CASES OF MULTIPLE PREGNANCY AND PREMATURE INFANTS	(NO.)	(%)	PRESENT SERIES OF 911 SINGLE BREECHES MINUS INFANTS UNDER 2,500 GRAMS AND THOSE IN WHICH THE TYPE OF BREECH PRESENTATION WAS NOT STATED (NO.)	(%)	
1	Extended legs	362	56	249	63	Extended legs
2	Gross fetal anomalies	21	3	3	1	Gross fetal anomalies
3	Fibroids	2	–	1	–	Pelvic tumors
4	Placenta previa	31	5	1	–	Placenta previa
5	Disproportion	13	2	15	4	"Contracted pelvis"
6	No abnormality recorded	222	34	128	32	No abnormality recorded
	Total Cases	651	100	397	100	Total Cases

In tabulating the author's series it was necessary to assign an arbitrary "order of etiological importance" since more than one factor was present in some cases. Accordingly the factors are ranked as shown, with extended legs assigned the greatest importance and contracted pelvis the least importance.

TABLE XI. SHOWING THE INCIDENCE OF EXTENDED LEGS IN X-RAY FILMS OF PREGNANCY AT OR NEAR TERM

Number of films examined	123	
Legs not visible (blurred by fetal movement, not included on the film, etc	–27	
	96	
Breech presentations (all had extended legs)	–4	
Cephalic presentations	92	100%
Both legs flexed at the knee	89	97%
One or both legs extended at the knee	3	3%

None of these films was taken for the purpose of investigating fetal attitude. They were made as an aid in the diagnosis of placenta previa, contracted pelvis, disproportion, and for other clinical reasons. All the infants ultimately were delivered in the same presentation as that shown on the films. The three babies whose presentation was cephalic but who had extended legs were delivered within forty-eight hours after the films were made; none rotated to a breech lie.

TABLE XII. SHOWING THE TYPE OF BREECH PRESENTATION AT THE TIME OF DELIVERY IN 377 INFANTS OVER 2,500 GRAMS AS RELATED TO THE DURATION OF GESTATION

TYPE OF BREECH (%)	WEEKS' GESTATION (ACTUALLY, WEEKS SINCE MENSTRUATION) 36	37	38	39	40	41	42	TOTALS CASES	PER CENT
Frank	28	50	55	63	65	66	68	233	62
Single footling	36	7	20	14	17	14	14	63	17
Double footling	36	29	22	19	14	14	9	61	16
Complete	0	14	3	4	4	6	9	20	5
Total %	100	100	100	100	100	100	100	377	100
Frank plus single footling	64	57	75	77	82	80	82	296	79

Since some of the single footlings are known to have had one leg extended ("half-frank" presentation) and others may have had one leg extended, data are shown for frank-breech-plus-single-footlings as well as for frank breech. The percentage of frank breeches is usually given as 80 per cent or more. The writer cannot explain the low incidence of frank breeches in the present series unless it arises in this way: There were 677 babies (over 2,500 grams) in the series, but the type of breech and the duration of gestation were stated only in the 377 cases shown above, leaving 300 breech deliveries of unknown type. Experience with hospital records teaches medical statisticians that, in general, unusual findings are more apt to be recorded than normal findings. Since the usual breech presentation is frank, while footling and complete breeches are exceptional, it may be that most of the 300 breech deliveries of unstated type were frank. If so, the oddly low incidence of frank breeches in the table above is understandable.

It has been shown in Table I that as gestation advances or the weight of the fetus increases, the incidence of breeches decreases. Among breeches the incidence of footlings also decreases as gestation advances (Table XII). Recalling that external cephalic version is most difficult for the obstetrician to accomplish when the legs are extended, hence least difficult when they are flexed, it seems reasonable to suppose that spontaneous version also occurs more easily when the legs are flexed. If this is so we may explain the decreased incidence of footlings in late pregnancy by assuming that most of them have undergone spontaneous version and are delivered as cephalic presentations.

16. *Cord complications,* such as short cords, or coils of cord around the extremities, may account for some breeches by interfering with spontaneous version. Prolapse of the cord occurred in 15 of the 677 breech deliveries. Twelve prolapses occurred in footlings, three in complete breeches, and not one in frank breeches. The absence of prolapse among the frank breeches (which constituted two-thirds of all breeches delivered) may be due to the fact that the frank breech more nearly fills the cervix than other types of breech presentation. However, if it could be shown that the slack length of the cord was decreased by its being coiled about the body or extremities, we should have a possible explanation both for the breech lie (by interfering with free motion of the extremities or with free longitudinal rotation of the fetus) and for the absence of prolapse. (Mengert and Longwell have shown that prolapsed cords are usually long cords. If a long cord should be coiled about the baby so that little slack remained it would seem unlikely that prolapse could occur.)

17. *Hypothetical explanation of breech presentations:* By piecing together the fragmentary data available, we can now form a rough idea of the gyrations of the fetus which lead to breech deliveries. Perhaps the order of events is something like this:

In the first trimester of pregnancy, the fetus is suspended in a spherical body of fluid of greater volume than itself and it manifests no consistent polarity. As the fetus grows, its body becomes larger in relation to its head, and its total volume increases in relation to the volume of the surrounding fluid. Moreover, as pregnancy progresses, the shape of the uterine cavity changes from spheroid to ovoid. At the same time the center of gravity and the center of buoyancy of the fetus are altered so that it tends to lie head downward rather than breech downward. If labor occurs at the thirty-second week of gestation, counting forty weeks as full term, or to use a more objective index of fetal age, when the fetus attains 1,500 grams, the factors influencing polarity produce a breech presentation in about one-sixth of the cases delivered (Table I).

The typical posture or "fetal attitude" is depicted at this age as extreme flexion of the neck, the body, the thighs, the legs, and the arms. From this starting position any motions must be toward a position of extension. Possibly full extension of the legs occurs often during this period and as long as there is ample room for free movement the legs easily return to the flexed attitude. If it happens that the amniotic fluid suddenly escapes, the uterus will contract and the fetus will be caught and delivered in his presentation of the moment. As we have seen, this is frequently a breech presentation for babies under 2,000 grams (Table I). However, if premature labor does not occur, the fetus increases in size and vigor while the space available for movement of the extremities decreases. The legs less readily become extended but once extended return to the flexed position with difficulty. As long as the legs are flexed it may be presumed that the fetus can "scramble" around. He is much like a squirrel in a rotating cage, but in this case the cage is fixed while the fetus is free to rotate inside it. For reasons by no means clear the fetus tends to assume a cephalic presentation in late pregnancy.* At term, about 97 per cent of babies are cephalic, about 3 per cent breech. Since the incidence of flexed legs at term is high among cephalic

*That gravity is effective in predisposing to cephalic presentations seems to be accepted. However, one should remember that in such horizontal animals as the cow and the mare, vertex deliveries are the rule and it would seem that in these animals the effect of gravity upon presentation would be minimal. I should not be astonished to be informed that long before man assumed the upright posture cephalic presentations were the rule. Perhaps the fetus faces the exit for the same reason that a person in an elevator faces the exit, or vice versa.

babies (Table XI) and low among breeches (Table XII), it is reasonable to assume a causal relation between extension of the legs and breech presentation. If we determine the incidence of extended legs among breech babies in relation to the duration of gestation, we find more and more frank breeches as term is approached (Table XII). This may mean that most of the breech infants with flexed legs have already been delivered, or it may mean that they have managed to convert themselves to cephalic presentations, leaving mainly the babies with extended legs helplessly caught in the breech lie. Either interpretation explains the decreasing incidence of breeches as compared with cephalics and of footling breeches as compared with frank breeches as gestation advances. Premature rupture of the membranes is particularly common if the foot lies over the internal os in such a way that motion of the legs may thrust a toe through the membranes. If this happens, the fetus is gripped by the contracting uterus and is born as a footling. Given a little more time these babies might have succeeded in converting themselves to a cephalic presentation.

Thus far we have assumed that there has been no interference with fetal movements and that the contour of the uterine cavity has been ovoid. However, it must sometimes happen that the cord is coiled about the body or neck, looped over the shoulder, or wrapped about an extremity. In such cases, spontaneous podalic version may be impossible either because the fetus is tied in a given position or because an entangling cord limits movement of the legs. It is in this way that coils of cord or short cords may be responsible for some breech presentations. In rarer instances the uterus itself may be faulty, for instance a septate uterus or a bicornate uterus. In such uteri one would not expect to find a perfectly ovoid cavity and there should be less likelihood of spontaneous version (Smith reports 47 per cent breeches in anomalous uteri). The contour of the uterine cavity may also be altered from without by the pressure of ovarian cysts or other pelvic tumors, or it may be altered from within by a submucous myoma or an abnormally implanted placenta.

In still other cases the uterus and cord offer no hindrance to version but the fetus itself is at fault. As a result of hydrocephalus, meningocele, dysplasia of the hips, cerebral agenesis, or some other congenital defect, its intrauterine vigor may be impaired. These defective babies, many of them breeches, are often accompanied by polyhydramnios, which is usually accepted as an explanation for their abnormal presentations. For my part, at present I am prepared to believe that the breech lie in such cases is due as much to uncoordinated or ineffective fetal activity as to excessive fluid.

The matter of recurrent breech births remains. In the majority of cases, it is as easy to believe that babies born of the same mother have similar peculiarities of skeletal structure or of intrauterine activity which account for their type of presentation, as it is to believe that the repeated breech births are due solely to a physiologic or anatomic characteristic of the mother.

Summary

Two aspects of the etiology of breech presentation have been considered. First, it has been found that the "classical factors" (contracted pelvis, pelvic tumors, placenta previa, and fetal malformation) in the aggregate account for only one-sixth of the breech births among mature single infants. Second, the data which have been assembled suggest that extension of the legs may be a causative factor rather than a resultant effect in breech presentations. The mechanism by which extension of the legs may operate to affect the presentation has not been fully discussed here. It is the writer's hope that within a few years he will be prepared to report current experiments which deal with the effects of gravity and of the contour of the fetal mass upon polarity. At that time, a review and correlation will be made of many important fundamental publications which have not been alluded to in the present study.

Statistics

Incidence of Breech Presentation.—

Cannell and Dodek	3.4%	in	16,166	deliveries
Danforth and Galloway	3.3%	in	8,531	deliveries
Moore and Steptoe	2.8%	in	51,571	deliveries
Morton	3.53%	in	8,509	deliveries
Patton and Mussey	4.87%	in	6,195	deliveries
Walsh and Kuder	4.72%	in	29,683	deliveries
Waters	4.3%	in	20,000	deliveries
Rathbun	2.4%	in	250	patients 15 or more days past term

Incidence of Contracted Pelvis in Breech Presentations.—

Cannell and Dodek	1.0%	in	550	breeches
Gordon, Garlick, and Oginz	5.3%	in	3,241	breeches
Higgins	1.0%	in	550	breeches
Morton	5.2%	in	285	breeches delivered vaginally
Seeley and Siddall	2.9%	in	456	breeches over 2,500 grams
Siegel and McNally	34.7%	in	167	breeches
Walsh and Kuder	12.7%	in	55	breeches in primiparas over 35 years
	11.02%	in		Clinic as a whole
Vartan	1.3%	in	969	breeches
	1.1%	breeches in 986 cases of disproportion		

Incidence of Congenital Defects in Breech Babies.—

Cannell and Dodek	2.7%	in	550	breeches
Gordon, Garlick, and Oginz	1.6%	in	3,301	breeches
Siegel and McNally	1.2%	in	167	breeches
Vartan	2.1%	in	969	breeches

Incidence of Placenta Previa in Breech Presentations.—

Cannell and Dodek	1.3%	in	550	breeches
Goethals	1.8%	in	1,219	breeches
Waters	0.9%	in	675	breeches (full term)
Vartan	3.2%	in	969	breeches
	8.0%	breeches in 387 cases of placenta previa		

Incidence of Breeches in Elderly Primiparas.—

Erving and Power	8.0%	in	199	patients
Nathanson	6.0%	in	186	patients
Roeder	9.0%	in	113	patients
Walsh and Kuder	6.73%	in	813	patients
Wahrsinger and Kushner	3.0%	in	111	patients

Incidence of Prolapsed Cord in Breeches.—

Cannell and Dodek	1.0%	in	550	breeches
Goethals	3.4%	in	2,093	breeches
Seeley and Siddal	3.3%	in	538	breeches
Siegel and McNally	3.0%	in	167	breeches

Elective External Version.—

Siegal and McNally advise against version on frank breeches

Ryder says that failure in accomplishing external version is due first to delay in attempting it, and second to extended legs.

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AN EVALUATION OF THE TREATMENT OF THE PERSISTENTLY UNENGAGED VERTEX IN THE MULTIPARA

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THE successful spontaneous termination of labor in the average multipara occurs with such great frequency that the obstetrician approaches the intrapartum multiparous patient with assurance tinged perhaps with a little indifference. The apparent lack of severe soft part injuries, the shorter labor, even the spontaneous delivery of some faulty positions and presentations is admitted and may account for a false sense of security. At times, therefore, complications arise which are not anticipated and are frequently overlooked with a resulting mortality to mother, baby, or both.

In the present discussion an effort has been made to evaluate the causes for lack of engagement and the use particularly of version and breech extraction for this condition in the multiparous patient. Several cases have been included in which versions and breech extractions were performed because of the presence of an additional complication, namely, prolapse of the cord.

Lack of Engagement in Multiparas

Engagement is primarily the result of relaxation and retraction of the lower uterine segment with the consequent passive descent of the presenting part through the pelvic inlet. In the majority of primigravidas the presenting part begins to come into the pelvis about two or three weeks before term, while the average multipara starts labor with an unengaged head. When engagement has failed to take place in the primigravid patient, the obstetrician is sufficiently aroused and, therefore, rechecks all of the factors involved to determine any obvious reason for such lack of engagement. Vaginal examinations and, at times, suitable roentgenograms are employed to study the existing relationship of the fetal head to the pelvis. On the other hand, most multiparous patients when seen at the onset of labor are found to have the presenting part either floating or just dipping into the inlet. An overwhelming proportion of these will descend into the pelvis as labor advances; in others the station of the head may remain unchanged until labor is far advanced, and then, with a few strong contractions along with the rupture of the membranes, the head descends into the pelvis. There remains the occasional multipara, however, in whom engagement fails to occur even though labor is far advanced.

The conditions which militate against engagement are either of a functional or pathologic nature and merit some discussion. The relaxed abdominal wall of the multipara may permit a faulty direction of the fetal axis and uterine forces, the net results of which may be a lack of progress in the descent

of the fetal head. Furthermore, faulty positions and presentations are also favored, and so one may encounter marked asynclytism with a persistent parietal presentation, brow or face presentation, as well as the poorly flexed vertex in the occiput transverse or posterior position. Under these circumstances, functional in origin, delay in engagement may occur but subsequently may be overcome, either as a result of the driving powers of good uterine contractions or the correction of the fetal axis spontaneously or by a proper abdominal support. Flexion and molding will then permit the passage of the smaller diameters through the pelvic inlet. A large distended bag of forewaters may prevent engagement until it ruptures spontaneously or is ruptured artificially, after which descent may take place. However, with the rupture of the amniotic sac in the presence of an unengaged vertex, irrespective as to the cause, an additional hazard may be encountered, namely, a prolapsed cord. This complication may necessitate a rapid method of delivery in the interests of the baby unless restoration of the cord is possible, which in most instances cannot be readily accomplished, or unless the vertex can be brought through the pelvis very quickly. Again, the presence of an absolutely short cord or a relatively short cord may cause delay in engagement of the vertex. Many multiparas approach the onset of labor poorly prepared to go through the ordeal, as a result of overwork, insufficient rest, anemia, too many and too frequent pregnancies, as well as some constitutional inadequacies. These patients may have a long labor, the result of inertia uteri, and so delay in engagement may be noted in them as well.

Other factors preventing engagement are ofttimes associated with definite pathology, as for example, cephalopelvic disproportion, unretracted fibroids obstructing the pelvic inlet, extrauterine neoplasms notably dermoids, placenta previa, or monstrosities such as hydrocephalus.

The general attitude toward the intrapartum multipara has been one of watchful expectancy if her previous history revealed spontaneous deliveries or deliveries attended with no great difficulty. Thus, this patient may be permitted to continue in labor with little or no progress for a variable period before the true state of affairs is recognized. When should an accurate appraisal be made in this patient comparable to that in the primigravida with the unengaged head? It is felt that if the presenting part is not advancing into the pelvis when dilatation is almost complete, or has failed to enter the pelvis soon after dilatation is complete in the absence of a large forebag, such a patient should not be permitted to continue for an indefinite time without a thorough investigation. Obviously, most of the afore-mentioned factors should have been recognized even before the onset of labor. The most difficult cases to evaluate, however, are those in which the presenting part has failed to engage due to a relative disproportion. The relative size of a baby may be difficult to appraise in the presence of an obese and pendulous abdominal wall. In addition, the weights of previous offspring spontaneously delivered or delivered with little difficulty may be grossly exaggerated. In many instances these incorrect weights are due to the fact that these deliveries had taken place at

home where accurate scales were not available or the patient may have failed to remember the correct weights of her offspring and in a boastful sense has exaggerated them.

Irrespective of the cause for lack of engagement, the continuation of labor with lack of progress may result not only in maternal exhaustion, hemorrhage, and infection, but another complication which has potentialities equally as dangerous or more so, namely, a tight contraction ring and a tonic uterus with possible subsequent rupture. The unengaged head, then, in a multipara who has been neglected in labor becomes a real hazard not only in the para viii or ix, *grande multiparae*, but in those of a lesser parity as well. For the ultimate delivery of these patients, high forceps have now been completely discarded. Since version and breech extraction would seem to be the next most suitable procedure, with cesarean section less suitable, this study of multiparas with persistently unengaged vertices delivered by version and breech extraction was undertaken at Bellevue Hospital in order to evaluate the results.

Indications for Version and Breech Extraction

From January, 1933, to August, 1944, an eleven and one-half year period, there were 21 multiparas who were delivered by version and breech extraction because of a persistently unengaged vertex. There has been a definite diminution in the frequency of this operative procedure, the justification of which becomes more apparent with a study of the end results. The ages of the patients in this series varied from 24 to 48 years. There were 19 white patients and 2 Negro. The number of previous term pregnancies varied from one to nine with a mean of four. The babies' weights varied from 6 pounds, 3 ounces, to 10 pounds, 13 ounces, and 62 per cent were over 8 pounds. In 10 cases the weights of the babies were less than the weights of previous siblings. In 6 cases the present weights were greater, while in 5 cases no comparison could be made since the weights of the previous babies were unknown.

An evaluation of the 21 pelves revealed that 14 were considered clinically ample for small to average-sized babies, as determined by vaginal examination alone. In 3 of these cases large babies accounted for cephalopelvic disproportions, and due to lack of recognition of this condition, version and breech extraction resulted in stillbirths. Two of the 21 were considered ample clinically and this was substantiated by postpartum x-ray studies. Three were thought to be clinically ample but were subsequently found to be contracted by postpartum x-ray examination: one was an android pelvis with an anteroposterior diameter of 9.8 cm. and transverse diameter of 10.0 cm., and the other 2 were platypelloid, with an anteroposterior diameter of 9.2 cm. and transverse diameter of 14.6 cm. in one, and an anteroposterior diameter of 9.4 cm. and transverse diameter of 12.3 cm. in the other. In all of these 3 distorted pelves, stillbirths resulted. The final 2 pelves were not evaluated clinically but postpartum x-rays revealed them to be ample. As to the position of the vertices there were 6 in left occipitoanterior; 3 in left occipitotransverse; 1 in left occipitoposterior; 3 in right occipitoanterior; 4 in right occiput transverse; and 4 in right occipitoposterior.

The length of the first stage of labor varied from 2 hours to 45 hours, an average of 13½ hours. The length of the second stage varied from 15 minutes to 7½ hours, with an average of 2½ hours.

For study, the cases in this series were divided into four groups, depending upon the indication which existed for version and breech extraction in addition to the unengaged head. The first group (Table I) consisted of those patients in whom lack of progress was the indication. There were 9 such patients [S.F., R.E., M.M.(1), H.M., F.D.R., M.M.(2), S.K., L.C., M.S.(1)]. Secondary uterine inertia was noted in six of these patients [S.F., M.M.(1), H.M., F.D.R., L.C., M.S.(1)], in one of whom [M.M.(1)] a bag was employed after cessation of contractions for twelve hours. Preceding the version and breech extrac-

NO.	NAME	YEAR	AGE	RACE	PARITY	WT. OF PREV. BABIES (LB.)	POSITION	PELVIS	FIRST STAGE (HR.)	SECOND STAGE (HR.)
1	S. F.	1933	38	White	2	7 6	L.O.P.	Clinically ample	24	7½
2	R. E.	1933	41	White	4	9½ 8½ ? ?	R.O.A. poorly flexed	Clinically ample	9	3
3	M. M. (1)	1933	37	White	4	Unknown	L.O.A.	Clinically ample	45	3½
4	H. M.	1933	38	White	5	10 10 8 8 10	R.O.P.	Clinically ample	15½	6½
5	F. D. R.	1935	34	White	3	5 4 5	L.O.T.	Clinically ample	7	6

INTRAPARTUM COURSE	POST-PARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
After being in labor 11 hr. membranes ruptured spont. Secondary uterine inertia ensued which was not helped by 3 min. pituitrin. Same dosage repeated after 7 hr. with same result. Finally reached second stage. Small rim of cervix remained but was considered fully dilatable. After 7½ hr. without progress, version and breech extraction performed. Difficulty with aftercoming head was encountered. Piper forceps used. F.H. good until delivery	Morbid 101 scale	8½ lb.	S. B.	(1) Bilateral tentorial tears (2) Subtentorial hemorrhage (3) Rupture of liver (4) Hemorrhage into adrenals
Membranes ruptured spont. 4 hr. after onset of labor. Head floating. For 3 hr. cervix remained at 4 plus F. though fully dilatable. Head was above level of spines. Bailey-Williamson forceps applied but no progress made with traction. Version and breech extraction performed with difficulty with arms and aftercoming head. Piper forceps used. F.H. good until delivery	Non-morbid	8¼ lb.	Died within 15 min.	No P.M. obtained
Polyhydramnios. Membranes ruptured spont. 8½ hr. after onset of labor with release of much meconium-stained fluid. Secondary uterine inertia ensued with cessation of pains despite castor oil and quinine. After 12 hr. without pains, cervix was long, thick, external os 4 F., internal os 3 F., vertex floating. No. 4 Voorhees bag inserted. Poor labor pains followed. After 6½ hr. bag fell out. After 45 hr. of 1st stage, version performed under ether anesthesia. Breech did not progress and was followed after delay by breech extraction. Piper forceps for aftercoming head. F.H. lost 32 hr. after onset of labor	Non-morbid	9½ lb.	S. B.	(1) Bilateral laceration of tentorium cerebelli (2) Subtentorial hemorrhage (3) Cephalohematoma
After 14½ hr. cervix became 4 F. dilated and membranes were artificially ruptured. Following this, secondary uterine inertia ensued and cervix remained unchanged at 4 plus fingers and fully dilatable. Head remained high. Kielland forceps applied but removed because head was too high. Version and breech extraction performed. F.H. good	Morbid 100.4 scale	9¾ lb.	Living	
Pre-eclampsia. After first stage of 7 hr., cervix was fully dilated, head unengaged. After 1 hr. without progress, membranes were ruptured artificially. For 3 hr. patient was encouraged to bear down with pains with very little progress. It was felt that cause for delay was uterine inertia and not disproportion. After 4½ hr. of second stage, Kielland forceps were attempted without success. Version was then attempted at which time a contraction ring was discovered. Under deep anesthesia and adrenalin, relaxation occurred. Version and breech extraction performed with difficulty, due to extended arms. Condition of patient poor; third degree laceration encountered and patient went into shock. Cephalopelvic disproportion	Morbid 101° scale. Stormy clinical course. Suppurative thrombophlebitis with septic pulmonary infarcts. Died suddenly 31st day	9 lb.	S. B.	*Mother:* (1) Thrombosis of left pulm. art. (2) Thrombotic infarction of lung (3) Fistula of bladder (4) Abruption of bladder from pubic attachment (5) Multiple foci of suppurative nephritis (6) Well-involuted normal P.P. uterus *Baby:* (1) Fracture dislocation of cervical vertebrae (2) Hemorrhage into spinal canal (3) Tentorial tear (4) Aspiration of amniotic fluid

TABLE I

NO.	NAME	AGE	YEAR	RACE	PARITY	WT. OF PREV. BABIES (LB.)	POSITION	PELVIS	FIRST STAGE (HR.)	SECOND STAGE (HR.)
6	M. M. (2)	1935	46	White	3	8 8 9½	L.O.A.	Clinically unknown. X-ray P.P.: gynecoid with anthropoid tendency	20	2
7	S. K.	1936	24	White	1	Unknown	L.O.T.	Clinically ample. P.P. x-rays: gynecoid A.P. –11.3 T. –13	2	3½
8	L. C.	1939	34	White	6	8 7 6½ 6 7 7	R.O.T.	P.P. x-ray: gynecoid with platypelloid A.P. –10.3 T. –13	18	1¾
9	M. S. (1)	1940	35	White	6	Largest 8	R.O.P.	Clinically ample	38	4½

tion, forceps delivery was attempted in six of the patients [R.E., H.M., F.D.R., M.M.(2), S.K., L.C.]. There was one instance of a tight contraction ring noted in this group (F.D.R.). There were five fetal deaths [S.F., R.E., M.M.(1), F.D.R., and S.K.] and one maternal death (F.D.R.).

There were two cases of maternal distress (F.M., and J.S.) both of which resulted in dead babies (Table II).

Fetal distress without an associated prolapsed cord was the indication for the termination of labor in two cases (G.C., and J.C.) and one dead baby resulted (G.C.) (Table III).

In eight cases there was a prolapse of the cord (Table IV). The membranes were ruptured artificially in two cases [M.S.(2) and V.R.] and spontaneously in six (S.P., T.D., A.M., K.T., E.T., and J.N.). The cervix was fully dilated in both cases of artificial rupture and one stillbirth resulted [M.S.(2)]. Where spontaneous rupture of the membranes occurred with prolapse of the cord, the cervix was fully dilated in three cases, 4½ fingers dilated in one, 4 fingers in one and 2½ fingers in one. Four fetal deaths resulted in this group [M.S.(2), A.M., E.T., and J.N.] as well as one maternal death (A.M.).

Results of Version and Breech Extraction

In summary, there were nine babies born dead and three died shortly after delivery, a total of twelve disastrous results or an uncorrected fetal mortality of 57.1 per cent. In all instances except four, the fetal heart was good up until the time of delivery. In one [M.M.(1)], the fetal heart was lost sixteen hours before delivery. In the second (G.C.),

—CONT'D

INTRAPARTUM COURSE	POST-PARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
Head floating. Membranes ruptured when cervix was almost completely dilated. Unsuccessful attempt with Tarnier forceps. Version and breech extraction performed. Manual removal of placenta, hemorrhage, shock	Morbid 100.4 scale	8 lb. 12½ oz.	Living	
After being in labor 2 hr. membrane ruptured spont. Vaginal examination revealed cervix to be 4 F. dilated but fully dilatable. Head floating in L.O.T. with ant. parietal present. After making no progress for 1½ hr. high Barton forceps applied but no progress with traction. Version and breech extraction performed. F.H. good until delivery	Non-morbid	9 lb. 4 oz.	S. B.	(1) Tentorial tear (2) Subtentorial hemorrhage (3) Subarachnoid and subdural hemorrhages (4) Laceration of vein of Galen (5) Subdural hemorrhage of cord
When cervix became 4 F. dilated, membranes were artificially ruptured. Head high. Following rupture of membranes cervix was only 3 F. dilated and pains became poor. When cervix became fully dilated, Kielland forceps attempted unsuccessfully. Version and breech extraction performed successfully	Non-morbid	7 lb. 1 oz.	Living	
Admitted with history of having been in labor 36 hr. Uterine inertia. Two hours after admission cervix found to be fully dilated with head floating. Membranes ruptured artificially. Given 3 minims pituitrin after 4 hr. with no progress. Version and breech extraction performed with difficulty	Morbid 101 scale	8 lb. 9½ oz.	Living Fract. of clavicle	

there was evidence of fetal distress by an irregular and slow heart prior to delivery. In the third [M.S.(2)] there was a prolapsed cord with slowing of the fetal heart, while in the fourth case (J.N.) the prolapsed cord was noted as pulsating. In the three latter cases there was an additional factor present, namely, cephalopelvic disproportion. It is felt that in the remaining eight cases the method of delivery was a factor in the production of stillbirths, with a consequent corrected fetal mortality of 38 per cent.

There were two maternal deaths, an incidence of 9.5 per cent. In the case of F.D.R. (Table I) there was secondary uterine inertia present, an attempt at forceps delivery was made, and a contraction ring added to the complications. Delivery was accomplished by a difficult version and breech extraction resulting from a definite cephalopelvic disproportion which was not recognized. After delivery the patient went into shock, and after a morbid postpartum course died on the thirty-first postpartum day from thrombosis of the left pulmonary artery and infarction of her lung. In addition, the postmortem examination revealed a fistula of the bladder, abruption of the bladder from its pubic attachment, multiple foci of suppurative nephritis, and a well-involuted normal postpartum uterus.

Mrs. A.M., who had been under the care of a midwife, was admitted to the hospital in active labor. The vertex was unengaged, the cervix 4½ fingers dilated, the membranes were ruptured for an unknown length of time, and the cord was prolapsed but pulsating. The fetal heart was good, a version was attempted and a contraction ring noted. Under ether anesthesia and adrenalin, the contraction ring was partially relieved and a version performed easily. Breech extraction followed, with difficulty in delivery of shoulders, and a stillbirth

TABLE II.

NO.	NAME	YEAR	AGE	RACE	PARITY	WT. OF PREV. BABIES (LB.)	POSITION	PELVIS	FIRST STAGE (HR.)	SECOND STAGE (HR.)
1	F. M.	1944	39	White	2	7¼	L.O.T. with asyne.	Clinically ample	6	2
2	J. S.	1937	26	White	2	1-7½ 2-Unknown	R.O.T.	Clinically ample. P.P. x-ray: platypelloid pelvis A.P. –9.4 T. –12.3	14¾	2

TABLE III. FETAL DISTRESS WITHOUT

NO.	NAME	YEAR	AGE	RACE	PARITY	WT. OF PREV. BABIES	POSITION	PELVIS	FIRST STAGE (HR.)	SECOND STAGE (HR.)
1	G. C.	1934	39	Negro	2	Unknown	L.O.A.	Diag. Cong. 11.25, P.P. x-ray: small android pelvis A.P. –9.8 T. –10	36	1
2	J. C.	1937	37	White	6	7¼ to 12 lb.	R.O.T.	Clinically ample	7	1

MATERNAL DISTRESS

INTRAPARTUM COURSE	POST-PARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
Fibromyoma uterus. Hypertension. Head floating in L.O.T. position with posterior async. After 6 hr. cervix was thought to be fully dilated on rectal examination with an unengaged head. Membranes ruptured spontaneously. Despite good pains there was no progress. After 1½ hr. general condition became poor with rapid pulse and prostration. Version performed with difficulty and Piper forceps employed for the aftercoming head. Mother aspirated vomitus, became cyanotic and for several minutes condition was grave. F.H. good at time of delivery. Cephalopelvic disproportion	Morbid 100° scale	9 lb. 13½ oz.	S.B.	Intracranial birth injury
Floating head. When cervix became fully dilated, membranes were artificially ruptured. After 1 hr. in second stage with vertex still unengaged, patient showed evidence of maternal distress: falling B.P. and rapid pulse. Kielland forceps applied unsuccessfully. Version and breech extraction performed with difficulty in delivery of aftercoming head. Piper forceps unsuccessfully applied. Cervix lacerated. P.P. hemorrhage—1,000 c.c., shock. Cephalopelvic disproportion—maternal distress (patient delivered by cesarean section with next pregnancy)	Nonmorbid	9 lb. 8 oz.	Died within 1 hour	(1) Subdural hemorrhage (2) Lac. of tentorium cerebelli (3) Fract. of occipital bone (4) Aspiration of infected amniotic fluid

AN ASSOCIATED PROLAPSED CORD

INTRAPARTUM COURSE	POSTPARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
Vertex was in L.O.A. position and remained floating throughout first stage of labor. After being in labor 32 hr. F.H. became slow and irregular. Cervix was thought to be fully dilated and membranes were artificially ruptured. Following this, cervix was found to be only 4 fingers and thick. F.H. continued to be slow and irregular. After 36 hr. of labor, cervix was dilated manually to full dilatation. In attempting to perform version, contraction ring was encountered which failed to disappear under ether anesthesia. High Kielland forceps was attempted unsuccessfully. Patient was given 10 minim of adrenalin, after which version and breech extraction were performed with difficulty. Fetal distress and cephalopelvic disproportion	Morbid 100° scale	7 lb.	S.B.	P.M. was not obtained
Vertex floating in R.O.T. position. After 6 hr. of labor, F.H. became irregular. Cervix was 4½ fingers dilated. One hour later cervix was fully dilated. Membranes were artificially ruptured and version and breech extraction performed	Nonmorbid	9 lb. 9 oz.	Living	

TABLE IV.

NO.	NAME	YEAR	AGE	RACE	PARITY	WT. OF PREV. BABIES	POSITION	PELVIS	FIRST STAGE	SECOND STAGE
1	M. S. (2)	1943	26	Negro	5	8 lb. 5 oz. 8 lb. 7 lb. 6 oz. 8 lb. 8 lb. 10 oz.	R.O.T.	Clinically ample	Combined 5½ hr.	
2	V. R.	1934	28	White	2	5½ lb. 9 lb.	R.O.P.	Clinically ample	6¾ hr.	15 min.
3	S. P.	1933	43	White	9	7 to 8 lb.	R.O.A.	Clinically ample	8½ hr.	30 min.
4	T. D.	1936	48	White	8	7 to 7½ lb.	L.O.A.	Clinically ample	Combined 7 hr.	
5	A. M.	1934	41	White	4	6 to 8 lb.	R.O.A. Comp'd with hands and feet	Clinically ample	Combined 6 hr.	
6	K. T.	1934	31	White	3	11 lb. (home) 7 lb. 7 lb.	L.O.A.	Clinically ample	4 hr.	45 min.

PROLAPSED CORD

INTRAPARTUM COURSE	POST-PARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
Patient was transferred from another hospital with cervix fully dilated and in moderately severe pre-eclampsia. Vertex was floating in R.O.T. position. Membranes were artificially ruptured with prolapse of small loop of pulsating cord. Cord was replaced and F.H. was heard beating 80-100 per min. Version and breech extraction performed with difficulty. Fetal distress and cephalopelvic disproportion were present	Morbid 100° scale	10 lb. 13 oz.	Died after 6 hours	(1) Fracture of cervical vertebrae (2) Incomplete laceration of spinal cord (3) Subdural, subarachnoid and intraventricular hemorrhages (4) Hem. into mediastinum (5) Hem. into lungs with aspiration
Vertex was floating and cervix was fully dilated when membranes were artificially ruptured. Cord prolapsed and reposition was unsuccessful. Version and breech extraction performed with no difficulty	Nonmorbid	7 lb.	Living	
Vertex floating and cervix thick and 2½ fingers dilated when membranes ruptured spontaneously with prolapse of cord. F.H. remained between 60-100 min. for next 1½ hr. until cervix became fully dilated. Version and breech extraction performed	Nonmorbid	8 lb.	Living. Depressed fracture of skull and Erb's Palsy of right arm	
After being in labor 6½ hr., membranes ruptured spontaneously with cervix dilated 4 fingers. Cord prolapsed. By time patient was ready for delivery, cervix was fully dilated. Version and breech extraction performed	Morbid 100° scale	7 lb. 5 oz.	Living	
Patient was under care of midwife and was admitted to hospital in active labor. Vertex was unengaged, cervix 4½ fingers dilated, membranes were ruptured for an unknown length of time, and cord was prolapsed but pulsating. Fetal heart was good, version was attempted and contraction ring noted. Under ether anesthesia and adrenalin, contraction ring was partially relieved and version performed easily. Breech extraction followed, with difficulty in delivery of shoulders, and stillbirth resulted. Two thousand c.c. blood loss was sustained, cervix was lacerated, and death followed in four hours	Maternal death	7 lb. 8 oz.	S.B.	P.M. not obtained
Membranes ruptured spontaneously with prolapse of cord while patient was receiving enema. Vaginal examination revealed vertex floating in L.O.A. position and cervix fully dilated. F.H. was good. Version and breech extraction easily performed	Morbid	6 lb. 3 oz.	Living	

TABLE IV

NO.	NAME	YEAR	AGE	RACE	PARITY	WT. OF PREV. BABIES	POSITION	PELVIS	FIRST STAGE	STAGE SECOND
7	E. T.	1935	31	White	5	12½ lb. 11 lb. 10 lb. 9½ lb. 8½ lb.	R.O.P.	Clinically ample	2 hr.	1 hr.
8	J. N.	1936	25	White	1	Unknown	L.O.A.	Clinically ample P.P. x-ray: Platypelloid A.P. –9.2 T. –14.6	6½ hr.	15 min.

resulted. Two thousand cubic centimeters blood loss was sustained, the cervix was lacerated and death followed in four hours. A postmortem examination was denied but it was the consensus of opinion that the patient had a ruptured uterus from an extension of the cervical laceration.

Discussion

Although this series is not large, there are significant facts which must not be overlooked; namely, a corrected fetal mortality of 38 per cent and a maternal mortality of 9.5 per cent. Careful scrutiny reveals the fact that version and breech extraction per se cannot be condemned, because in 9, or 42.9 per cent, of the cases in which no other complications existed, satisfactory results were obtained. There is a tendency, however, to perform version and breech extraction without a thorough investigation of the causes for the persistent lack of engagement, which factors may act as contraindications for this procedure.

In this series, it was found that in the twelve cases with disastrous results, six patients had cephalopelvic disproportion. Although in three of these six cases there were also evidences of fetal distress, it was felt that cephalopelvic disproportion contributed toward this distress [G.C., M.S.(2), and J.N.]. Furthermore, delivery by version and breech extraction was accomplished with difficulty and resulted in stillbirths in which definite evidences of birth injuries were found. Unfortunately, an accurate appraisal of the size of the baby by clinical means is not always easy, especially in a multipara with an obese, pendulous abdominal wall. In addition, one usually seems less concerned in this type of patient after obtaining a history of spontaneous deliveries of moderately large babies. However, in those instances in which successive pregnancies are associated with progressively larger babies, the point may finally

—CONT'D

INTRAPARTUM COURSE	POST-PARTUM COURSE	WEIGHT OF BABY	RESULT (BABY)	POSTMORTEM FINDINGS
Vertex floating. Membranes ruptured spontaneously with prolapse of cord. Cervix was fully dilated. Version and breech extraction performed with difficulty due to extended arms. Piper forceps used for aftercoming head. F.H. was good until time of delivery	Nonmorbid	8 lb. 12 oz.	S.B.	(1) Multiple subpleural hemorrhages (2) Multiple subcapsular hem. of liver (3) Hem. into right adrenal (4) Aspiration of amniotic fluid and meconium
After being in labor 6 hr., membranes ruptured spontaneously with prolapse of pulsating cord. By time patient was prepared for delivery, cervix was fully dilated with vertex floating. Version and breech extraction performed with difficulty with aftercoming head. Piper forceps used. Fetal distress (?) and cephalopelvic disproportion	Morbid 101° scale, P.P. psychosis	7 lb. 10 oz.	S.B.	(1) Tear of tentorium cerebelli (2) Subdural and subarachnoid hemorrhage

be reached when a baby may be too large to come through a pelvis which apparently was adequate for previous passengers. A very accurate study of the pelvis by other than clinical means in the average multipara is infrequently obtained if the patient was capable of delivering previous offspring either spontaneously or with a minimum of difficulty. Yet, she may possess a pelvis which is normal or distorted and moderately contracted, and which, while adequate before and apparently clinically ample, may account for a serious disproportion with only a moderate increase in the size of the present passenger. It should be stressed that in a multipara with a persistently unengaged vertex, one should exclude the presence of cephalopelvic disproportion before attempting version and breech extraction. If this cannot be determined by clinical means, stereoroentgenograms may be employed.

The persistent presence of a rim of cervix in the multipara with an unengaged head and ruptured membranes is not unusual and the judgment as to how negotiable such a rim may be for the safe delivery of the baby by version and breech extraction requires a nicety of judgment on the part of the operator. There were four cases in which the cervix was considered to be negotiable but in which difficulty was encountered in the performance of version and breech extraction, with resulting stillbirths and one maternal death. Possibly, if the version had been performed and the breech extraction delayed until the cervix had become fully dilated, results in this group might have been more favorable. At any rate, the maternal death could have been prevented.

Neglect in labor in the multipara unfortunately is not uncommon because of the laissez-faire attitude of the obstetrician toward this type of patient. There were 10 cases in this series in which there was a prolonged second stage

which varied from 1¾ to 7½ hours, with a cervix considered to be fully dilated or fully dilatable. It is the attitude of this obstetric service, in more recent years, in order to prevent neglect in labor to intervene or at least investigate thoroughly the multipara with an unengaged head after a second stage of thirty minutes without progress.

During the ten-year period from 1933 to 1943 there were 22 cesarean sections performed after the onset of labor on multiparous patients in whom there was persistent lack of engagement of the vertex and in whom cephalopelvic disproportion was appreciated early in labor. One fetal death resulted from birth injuries (intracranial hemorrhage and tear of the falx cerebri) after a 9½-hour labor with 5½ hours of ruptured membranes. There were no maternal deaths in this group.

Conclusions

1. Version and breech extraction for the unengaged head in the multipara was associated with a corrected fetal mortality of 38 per cent and a maternal mortality of 9.5 per cent.

2. The failure to recognize cephalopelvic disproportion accounted for 50 per cent of the fetal deaths. In the presence of failure of engagement in the multipara, therefore, version and breech extraction should not be performed unless there is absolute proof that no disproportion exists.

3. The presence of a residual rim of cervix may be a very definite hazard in the performance of a version and breech extraction. Version may be safely executed but the breech extraction deferred until the cervix offers no obstruction.

4. Upon recognition of cephalopelvic disproportion, cesarean section is the procedure of choice. In twenty-two such cases there was but one fetal death (4.5 per cent) and no maternal deaths.

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DELIVERY AFTER CESAREAN SECTION

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THE method of terminating pregnancy following cesarean section is still a controversial matter in the present-day practice of obstetrics. Numerous articles have been published favoring or discrediting the famous dictum "once a cesarean, always a cesarean." There have been relatively few series of cases of pregnancy following cesarean section published, especially in the English literature, to illustrate the truth or fallacy of such a statement. At this time we do not wish to present any additional argument on the subject, but merely to record the outcome of all viable pregnancies which have been delivered in the Woman's Clinic of the New York Hospital following a previous cesarean section. This study covers a twelve-year period from Sept. 1, 1932, to Dec. 31, 1943, and consists of 445 viable pregnancies following a previous section.

In this clinic, each pregnancy following cesarean section is carefully evaluated as an individual problem. The patients are referred to the Dystocia Clinic where they are followed in the latter weeks of their pregnancy by one of the senior physicians. By this time, abstracts of their previous history have been obtained, so that in the great majority of cases the indications for the previous section, and the course of the puerperium are known. Each patient is carefully examined to determine pelvic measurements, approximate size and position of the fetus, and the condition of the scar. Admittedly, examination of the scar is unsatisfactory in the majority of cases, but, in a few, the defect could be palpated through the diastasis of the abdominal muscles. All cases of previous disproportion or relative disproportion are x-rayed, and the measurements and morphology of the pelvis are determined by isometric and stereoscopic methods. Patients are instructed to report any abdominal pain or soreness, and to enter the hospital before their expected date of confinement to await the onset of labor. If labor begins or the membranes rupture before admission, they are to report immediately. In the hospital, they are again re-evaluated by the attending staff. If an elective section is not done, labor is carefully observed and close attention focused on tenderness over the scar, pulse, and fetal heart rate.

Listed in Table I are the indications for the original section in the entire series. In approximately 25 per cent of the cases (112) the original section was performed in this clinic; the other three-fourths were performed elsewhere and came here for a subsequent pregnancy. The indications, in general, are the same in both groups. In our own cases, we have a smaller percentage of patients with disproportion or relative disproportion, and a somewhat greater number of patients with placenta previa and premature separation of the

TABLE I. INDICATIONS FOR ORIGINAL SECTIONS

	TOTAL CASES	SECTION N.Y.H.
Disproportion	253	55
Relative disproportion (i.e., disp. with breech, hydroceph., x-ray disp., unengaged vertex after 12-hour trial of labor)	26	5
Defective powers of labor (i.e., weak uterine scar, desultory labor, cervical dystocia, constriction ring)	30	4
Premature separation of placenta	23	15
Placenta previa	38	11
Abnormal presentation	15	6
Severe pre-eclampsia or eclampsia	20	6
Obstruction to soft parts (i.e., cysts, vesicovaginal fistula)	4	1
Fetal distress (i.e., prolapsed cord, maternal disease)	3	2
Elderly primigravida	3	2
Miscellaneous	7	3
Unknown	15	0

TABLE II. TYPE OF PREVIOUS SECTION

Classical	169
Cervical	141
Extraperitoneal (Latzko)	21
Peritoneal exclusion	1
Total	332

TABLE III. TYPE OF DELIVERY AFTER PREVIOUS SECTION

Cesarean section		257	(58%)
Classical	165		
Cervical	87		
With hysterectomy	5		
Vaginal, operative		98	(22%)
Low forceps	65		
Midforceps	17		
Breech extraction	8		
Other	8		
Vaginal, spontaneous		90	(20%)

placenta. The type of previous section was known in 332 patients, as shown by Table II. In patients with more than one section, that occurring just prior to the present pregnancy is the one recorded.

Table III shows the type of delivery which occurred after cesarean section. Fifty-eight per cent of the patients were delivered by another section. About two-thirds of these were classical sections, and one-third, low flap. There were five sections with hysterectomy because of ruptured uteri. Forty-two per cent of the patients were delivered vaginally. Slightly more than one-half of the vaginal deliveries were operative, and the remainder spontaneous.

Among those patients delivered by repeated section, there are several points of interest. As would be expected, disproportion was the most frequent indication for repeated section (Table IV). A large proportion, 25.8 per cent, were indicated because of a defective uterine scar or febrile puerperium. There was a high incidence of premature separation of the placenta and placenta previa which occurred in this group of patients requiring another section, the incidence being 2.5 per cent as compared to the clinic incidence of 0.84 per

TABLE IV. INDICATIONS FOR SECTION AFTER PREVIOUS SECTION

Disproportion	140
Previous section with fever or defective scar	66
Relative disproportion	7
Previous section	14
Premature separation	4
Placenta previa	7
Abnormal presentation	5
Severe pre-eclampsia	2
Obstruction to soft parts	2
Elderly primigravida with previous section	3
Fetal distress	2
Maternal disease	1
Miscellaneous	4
Total	257

cent. One patient had cesarean sections for premature separation of the placenta on two occasions, and two cases of placenta previa had a repeat section for the same indication.

In cases of vaginal delivery, a routine low forceps is considered the procedure of choice after a previous section. In many cases this procedure was not followed, and in others low forcep deliveries were performed for other indications, as shown in Table V.

TABLE V. INDICATIONS FOR OPERATIVE VAGINAL DELIVERY AFTER PREVIOUS SECTION

	LOW FORCEPS	MID-FORCEPS	HIGH FORCEPS	BREECH EXTR.	MANUAL REMOVAL PLACENTA	BAG INDUCT.	VERSION EXTR.	MANUAL DILATION OF CERVIX
Previous section	51	10						
Prolonged 2nd stage	2	2						
Lack of progress in 2nd stage	3	1						
Fetal distress	7	1	1					
Breech				8				
Retained placenta					2			
Maternal distress		2				1		
Mild pre-eclampsia	1							
Transverse presentation (1 twin)							2	
Severe pre-eclampsia						1		
Pulmonary tuberculosis	1							
Intrauterine infection		1						
Cervical stenosis								1

The most marked variation in incidence of vaginal deliveries following cesarean section is found in the group where previous section was performed for the indication of disproportion, as compared to that group in which disproportion or relative disproportion did not enter into the original indication. Of 253 previous sections for disproportion, 78, or 31.7 per cent, had a vaginal delivery at this time. Among 80 of these patients who had had two sections for disproportion, 12 were judged capable of vaginal delivery and went through labor without incident. In contrast to this group are the patients who had previous sections for severe pre-eclampsia, abnormal presentations, desultory labor, and other abnormalities which are not likely to be present in succeeding

pregnancies. This group should represent the greatest possible percentage of patients with vaginal deliveries after section. Among 124 of these patients, 73, or 58.9 per cent, delivered vaginally, the remainder by repeated section.

The more cesarean sections a patient has had, the less chance there is for vaginal delivery to occur in a following pregnancy, and the more vaginal deliveries a patient has had, particularly following a cesarean section, the greater is the probability of vaginal delivery. This is well shown in Table VI.

TABLE VI. TYPES OF DELIVERY AMONG PATIENTS WITH PREVIOUS SECTION

	REPEAT SECTION	VAGINAL DELIVERY
No. with previous section only (315)		
248 one section	148	100
52 two sections	40	12
9 three sections	9	0
5 four sections	4	1
1 five sections	1	0
No. with vaginal delivery prior to section (85)	45	40
No. with vaginal delivery following section (45)		
34 one vaginal delivery	4	30
8 two vaginal deliveries	2	6
2 three vaginal deliveries	0	2
1 seven vaginal deliveries	0	1

Of 85 patients who had vaginal delivery prior to section, 40, or 47.1 per cent, were delivered vaginally after section. However, among patients who had a vaginal delivery following cesarean section, 86.6 per cent again delivered per vaginam. One patient had as many as eight vaginal deliveries following a previous section. Theoretically, the entire group should have delivered normally, but in six, added complications, such as placenta previa, premature separation of the placenta, and abnormal presentation made a repeated section necessary. Section was performed in four patients with one intervening vaginal delivery, and in two with two vaginal deliveries after a previous section. There were 248 patients in this series whose only previous pregnancy had been terminated by cesarean section. In a second pregnancy, a repeated section was performed in 148 cases (58.8 per cent) while 100 (40.3 per cent) delivered vaginally. Fifty-two patients had two previous sections and, among these, only 12 (23.1 per cent) delivered vaginally. The greatest number of sections performed on one patient was six.

In general, it is our policy to sterilize a patient at the time of her third cesarean section. With multiple scars in the uterus, pregnancy is thought to become increasingly hazardous. Sterilization was performed in 67 cases, generally by the Madlener or Pomeroy technique. We have not had any of these patients return, but one patient, who had been sterilized elsewhere, returned here for delivery. Among the 67 sterilization operations at the time of section, 56 patients had three or more living children. Eleven had only two children, but in these cases other indications were also present, such as rheumatic heart disease, hypertension, and marked defects in the uterine scar.

Though there are a large number of patients who have a repeated cesarean section, not all of these have elective operations, but many are given a trial of

labor. Of 253 repeat sections, 76.3 per cent were elective, and the remainder were allowed to go into labor. The average trial of labor lasted 10 hours and 48 minutes. In general, the decision as to whether or not a section was necessary was made before 18 hours of labor. However, there were two cases with a prolonged trial of labor of 40 and 60 hours, after which section became necessary.

The labor of patients having vaginal delivery following a previous section has recently been reviewed by Kuder and Dotter from this clinic. Among patients who had no previous vaginal delivery, labor following cesarean section was similar to that of a primigravida, and lasted an average of 17 hours and 58 minutes. Among patients who had a previous vaginal delivery, labor followed closely the pattern of multiparous labor and lasted an average of 10 hours and 48 minutes. The incidence of prolonged labor, or those of over 30 hours' duration, is 7.5 per cent, and that of precipitate labor of three hours or less is 3.2 per cent; this compares with the clinic incidence of prolonged and precipitate labor which is 9.5 per cent and 6.1 per cent respectively.

TABLE VII. PRESENTATION

	PREVIOUS SECTION PATIENTS		GENERAL CLINIC
	NO.	PER CENT	PER CENT
Vertex	399	91.5	95.0
Transverse	8	1.83	0.09
Face	3	0.66	0.27
Breech	26	5.96	4.0
Twins (not included)	4		
Unknown	4		

As shown in Table VII, there is an unusually high incidence of abnormal presentation among these patients which may be explained on the basis of poor pelvic architecture. Fourteen of the patients with a breech presentation had had a previous section for disproportion, two had previous sections for abnormal presentations (face and chin), and one had a bicornate uterus. The patients with face presentations had all had previous sections for disproportion. Among patients with transverse presentation, one had had two previous sections; and another, one previous section, all of which were again indicated because of transverse presentation. One of these also had a pelvic kidney, and the remainder had previous disproportion with sections in earlier pregnancies. Forty-three out of 399 vertex presentations, or 12.4 per cent, were in the posterior position as compared with the usual clinic incidence of 7.9 per cent.

As one might expect, the pelvic measurements among patients with previous section are remarkable only among those in whom the indication for section was disproportion. In this clinic a pelvis with a diagonal conjugate of 11.7 cm. or below, or an intertuberous diameter of 8.5 cm. or less, is considered contracted and likely to cause dystocia. Fifty-two patients out of 253 who had a past history of disproportion had pelvic measurements which were considered within normal limits. However, the general average for the entire group with disproportion as a previous indication for section was 11.3 cm. for the diagonal conjugate, and 8.8 cm. for the intertuberous diameter. There were

only seven with a diagonal conjugate of 10 cm. or below. The smallest pelvis had a conjugate of 7.5 cm. and a transverse inlet diameter of 7 centimeters.

During recent years, the x-ray has been used more and more frequently as a check on clinical pelvic measurements. In the past, x-ray diagnosis of cephalopelvic disproportion has been notably unreliable, and has undoubtedly been considerably abused. Even now, with accepted methods of pelvimetry, mistakes in judgment are made. There were four patients in this series who had previous sections for disproportion which were based, to a large extent, on x-ray findings. At least one of these patients had an accepted type of x-ray pelvimetry; but when an x-ray series was repeated here, our interpretation was not in accord with the former one and she had an uneventful vaginal delivery.

In this clinic, x-ray interpretation and diagnosis is made by an obstetrician on the staff who, however, has had no contact with the patient whose x-ray he is interpreting. Up to the present time, we have not allowed our clinical judgment to be influenced by his opinion, but use it rather as corroborative evidence of what we find after clinical evaluation. We use the Caldwell and Moloy stereoscopic technique which, in turn, is checked by isometric pelvimetry as developed by Steele and Javert of this clinic. As previously stated, part of our routine check on patients with previous section for any questionable disproportion consists of pelvic x-rays. It should be remembered that x-ray evaluation of these patients is made without any knowledge of their previous obstetric history.

The x-ray had not been used extensively in this clinic until the past four or five years, and, consequently, there are only 92 patients with a previous history of disproportion on whom we have secured x-ray data concerning the type of pelvis or prognosis as to method of delivery.

TABLE VIII. X-RAY DIAGNOSIS IN PATIENTS WHO HAD PREVIOUS SECTION ON BASIS OF DISPROPORTION

Elective section	21
Probable section	14
Possible section	21
Vaginal delivery with transverse arrest	8
Vaginal delivery without difficulty	28
Total	92

As shown in Table VIII, in 64 out of 92 cases, trouble was predicted after an x-ray study of the pelvis. In 21 patients, elective section was dogmatically advised. Almost invariably these patients had unusually poor pelvic measurements, and overriding of the fetal head could be demonstrated clinically. However, a didactic opinion of this type is rare. In most cases, the opinion as to probable and possible section are direct interpretation of the x-ray man's description. With statements such as: "poor pelvis, trouble all the way; will need hard long labor," or, "if head engages it may mold through with hard labor," a section was considered "probable." Fourteen cases fell into this

group. With less emphatic statements such as: "advise trial labor," "if vertex engages will deliver vaginally" or "will need good labor to deliver," section was considered "possible"; there were 21 such cases. In 8 patients vaginal delivery was advised, though trouble could be seen in the midpelvis and outlet; in the majority of these transverse arrest was predicted. In 28 cases vaginal delivery or an easy forceps was assured.

TABLE IX. TYPE OF PELVIS IN PATIENTS WHO HAD PREVIOUS SECTION FOR DISPROPORTION

TYPE OF PELVIS	TYPE OF DELIVERY PREDICTED BY X-RAY			
	ELECTIVE SECTION	PROBABLE SECTION	POSSIBLE SECTION	VAGINAL
True Gynecoid	7	6	3	7
Gynecoid-android	1		3	3
Gynecoid-anthropoid	1		2	1
True android	5	2	3	2
Android-gynecoid	2	1	4	3
Android-anthropoid			1	1
Android-platypelloid	2		1	
True anthropoid	1			1
Anthropoid-gynecoid				2
Anthropoid-android		1		
True platypelloid		1	1	1
Platypelloid-gynecoid			1	1

The type of pelvis is described in 71 of these patients (see Table IX). The multiplicity of pelvic forms are described by the classification of the posterior and anterior segments of the inlet into one of the four main morphologic types which they resemble most closely. This group of pelves is too small to permit definite conclusions. It has been shown, however, that in a group of contracted pelves the number of gynecoid forms decreases, while the number of android and flat pelves increases in frequency. The number of flat pelves show no variation from their normal incidence in the present series, but there is a decrease in the number of gynecoid forms and an increase in the number of android types. The gynecoid pelvis is usually found in 56 per cent of patients in the general clinic and the android in 19 per cent. In this series, though, the gynecoid is most frequent (48 per cent), the android type appears about twice as frequently as one would expect in a normal group of pelves (38 per cent).

Another consideration of general interest in patients with previous cesarean section is the appearance of the uterine scar at the time of delivery in a succeeding pregnancy. A description of the scar, or a definite statement that no defect is noted in the uterine wall, should be included in the operative or delivery note of each patient. This information is extremely helpful for the evaluation of future pregnancies. Unfortunately, a definite note of the uterine scar was made in only 168 patients in our series. It is probable that notable defects in nearly all the patients who delivered by section are recorded, for abnormalities are generally well described in the operative notes. Therefore, the number of defects described at the time of cesarean section are more likely the defects represented in the entire series rather than the small group which

we have recorded here. Among the 168 cases where attention was directed to the previous cesarean scar, it was noted in 146 sections and 22 vaginal deliveries.

TABLE X. TYPE OF PREVIOUS SECTION WITH DEFECTIVE SCAR

Classical	40
Cervical	15
Latzko	3
Unknown	6
Total	64

Table X shows the type of previous section in cases with defective scars. From the figures presented in this table, the greatest number of defects noted were in the classical type of cesarean section. However, as we have shown in Table II, the classical section was performed in over half of the patients, and data are too inconclusive for any statement as to whether the type of section per se was a factor in increasing the incidence of uterine defects. Furthermore, a small defect would be more easily detected in the scar of the classical section.

TABLE XI. TYPE OF DELIVERY IN CASES WHERE DEFECT NOTED

Cesarean section		54
Previous section with fever	15	
Defective scar	12	
Disproportion	20	
Previous section	2	
Ruptured membranes and floating head	2	
Ovarian cyst	1	
Placenta previa	1	
Premature separation of placenta	1	
Operative vaginal delivery		7
Low forceps	3	
Midforceps	2	
Breech	1	
Version-extraction	1	
Spontaneous vaginal deliveries		3
Total		64

We have already stated that 25.5 per cent of repeat cesarean sections were performed on the basis of a defective uterine wall, either because of a febrile puerperium or faulty repair of the uterine wound. The indications for operation among patients in whom defects were noted in the previous scar are listed in Table XI. In the 46 sections where some degree of faulty union was observed in the previous scar, 22 were suspected prior to operation. The majority of the sections were indicated on the basis of disproportion; less than one-half were indicated because of a defective scar. The difficulty of evaluating the condition of the uterine scar prior to labor is well illustrated by the 62 patients in whom operation was indicated because of a suspected weak scar. Twenty-two, or about one-third, had uterine defects of all degrees; in 18 the scar was well healed or no defects could be noted; in the remaining 22, no mention was made of the previous scar which may be presumed to be unremarkable. However, the history of a febrile puerperium still remains an im-

portant consideration in evaluating a patient in a succeeding pregnancy, as the uterine defects may be expected in one of three such patients, while the incidence among other patients would appear to be much lower. Nine patients who delivered vaginally were noted at examination after delivery to have uterine defects, but in only one, where a wide thin scar was described, were further vaginal deliveries felt to be contraindicated.

TABLE XII. UTERINE SCAR AS DESCRIBED AT TIME OF REPEAT SECTION

No evidence of previous scar	61
Scar well healed	18
Adhesions but no defect	9
Scar thin	18
Small defect	10
Thin with defect	10
Very thin	13
Ruptured	6

The types of uterine scar, as described at the time of cesarean section, are listed as briefly as possible in Table XII. In the majority of cases (60.3 per cent), the scar was either not identified as such, or was described as well-healed. In cases where the scar is listed as thin or with a small defect, in our opinion, the patient could have withstood labor without danger of rupture. In these patients, the myometrium was somewhat thinner along the scar of the previous section, or there were small depressions (1 to 2 cm.) in the muscularis. There were 23 patients in whom the scar was very thin, or who had large defects in the muscularis. In several of these patients, the uterine wall was described as 1 to 3 mm. thick, and many in this group would undoubtedly have ruptured the scar with good labor. The patients with ruptured uteri will be discussed in detail.

The incidence of ruptured uteri was 1.7 per cent. Pertinent data concerning these cases of ruptured uteri is presented in Table XIII. Rupture occurred

TABLE XIII. PATIENTS WITH RUPTURED UTERI

PARA	TYPE OF PREVIOUS DELIVERY	INDICATION FOR PREVIOUS DELIVERY	FEVER IN PREVIOUS PUERPERIUM (DAYS)	DURATION OF LABOR (PRES. PREGNANCY)	TYPE OF DELIVERY	RUPTURED SCAR	FETAL MORTALITY
I	Cervical	Disproportion	10	Early—1 hr.?	Hysterectomy	Yes	0
I	Classical	Placenta prev.	3	17 hours	Hysterectomy	Yes	1
I	Classical	Prem. separ.	2	Early	Class. section	Yes	0
III	3 Classical	Disproportion	3-2-3	10 hours	Hysterectomy	Yes	1
II	1 Breech ext. 1 Latzko	Chin post.	10	0	Low-flap sect.	Yes	0
II	1 Cervical 1 Breceh ext.	Face post.	4	17 hours	Hysterectomy	No	1
II	2 Cervical	Disproportion	5	12 hours	? cervical	Yes	1
II	1 Forceps 1 Cervical	Disproportion	3	18 hours	Midforceps Hysterectomy	No	1

three times among those with a previous classical section; three times with a previous low-flap section, once following a Latzko section, and once in a patient where the nature of the previous section was not known, but was believed to be of the cervical type. There is no indication among this group that ruptures occur more frequently following the classical operation, for, as we have already shown, the majority of sections were of this type. In two patients with ruptured uteri, it was very difficult to correlate the rupture with their previous cesarean scar. These cases are reported as follows:

The first case is a 30-year-old para ii, gravida iv, who had a low flap section nine years previously because of a posterior face presentation. Six years previously she had an uneventful breech delivery in this clinic of a 3,900-gram infant. After a normal antepartum course in this present pregnancy, she was admitted in early labor. Twelve hours after moderate and normal labor, the cord prolapsed but was readily replaced. Five hours later, when full dilatation was attained, a midforceps delivery was attempted. Tarnier forceps were applied, but the vertex failed to descend and with continued traction the blades slipped. Vaginal examination revealed a transverse defect in the anterior vaginal wall at the level of the cervicovaginal junction. At laparotomy, a deep and extensive laceration was found to involve nearly the entire vaginal wall extending upward through the cervix and lower uterus. A subtotal hysterectomy was performed. On examination of the uterus there was a laceration extending upward on the left lateral aspect of the uterus for a distance of 4 cm. The scar of the previous section was not detectable.

The second case is a para ii gravida iv, whose first delivery terminated by a difficult forceps and a deadborn infant. Five years ago she had a low flap cesarean section for disproportion. In her present pregnancy she was admitted at term in mild labor. After seven and one-half hours of good labor, the fetal heart was lost and the cervix 8 or 9 cm. dilated. Three hours later, when the cervix was fully dilated, the patient was delivered by midforceps of a 2,550-gram infant. On manual exploration of the uterus, a rupture was felt through the musculature, and the patient's blood pressure began to fall. At laparotomy, a large hematoma was noted under the peritoneal reflection of the bladder. Due to the laceration, it was difficult to make out the landmarks, but, starting at the angles of the rupture, an incision was carried posteriorly and the uterus removed. The pathologic description of the gross specimen is as follows:

"As one explores the uterine cavity, there is a fissure in the midline of the anterior wall extending from a point just within the external os to a point running up into the body of the uterus. This may well be the healed scar from the previous section. There is no muscular defect in this area. On bisecting the specimen, there is no evidence of rupture. From gross examination, it seems we are dealing with a rupture of the vagina occurring in the anterior wall beneath the bladder and 2 cm. from the cervix."

In three patients, rupture occurred at the onset of labor, or before the pains were well established; in the remaining five, labor was well established and varied from ten to eighteen hours in duration. One patient failed to come into the hospital at the onset of labor, but remained at home for ten hours, and was admitted in shock. The remaining were observed early in labor when there was no sign of impending rupture. Usually the signs of rupture developed suddenly, with pain, loss of fetal heart, and rising pulse, occurring in sequence or coincidentally. The fetal death rate among these cases was 60 per cent. No fetal death occurred in three patients where rupture occurred early in labor. When rupture occurred later, the fetal mortality was 100 per cent. There were no maternal deaths in this series. We attribute this directly to

close observation, available blood for transfusion, and prompt action. The only patient who went into deep shock had not come to the hospital early, and rupture occurred at home. Hysterectomy was performed in five of the eight cases. In three, the separated scar was freshened and repaired. One of these cases had a tubal ligation; another one has since had another pregnancy which terminated in cesarean section. All of these patients had had a previous febrile puerperium, yet in most the fever was mild; only two patients had fevers of over five days' duration.

TABLE XIV. MORBIDITY, INCIDENCE 29.8 PER CENT

TYPE OF DELIVERY		INCIDENCE %
Spontaneous delivery		6.6
Operative vaginal delivery		17.3
Cesarean section		42.4
Classical	39.4	
Cervical	45.9	
Section with hysterectomy	66.6	

Puerperal morbidity is defined in this clinic as a fever of 38° C. on two or more successive days (and lasting longer than twenty-four hours) excluding the day of delivery. There were very few extragenital causes of fever among the patients in our series, so that in general, postpartum morbidity can be attributed to puerperal sepsis. The incidence of morbidity occurring in this group is 29.8 per cent. This is abnormally high and is accounted for by the large number of cesarean sections performed, which are responsible for 82.6 per cent of the total puerperal morbidity. The morbidity in relationship to the type of delivery is shown by Table XIV. The morbidity following full-term spontaneous deliveries was 6.6 per cent; following operative vaginal deliveries, 17.3 per cent; but following cesarean section, it rose precipitously to 42.4 per cent. The highest morbidity in section cases was associated with the low flap type where the incidence was 45.9 per cent compared with 39.4 per cent with the classical type. The difference can undoubtedly be explained by the fact that 42 per cent of the patients with morbidity and the low flap section had had labor, while only 21 per cent of febrile patients with the classical section had had labor, which averaged shorter in duration. Generally, the febrile reactions were mild, lasting only 2 or 3 days. Only 16 per cent of the total morbidity was caused by fevers lasting over five days.

The high operative morbidity raises the interesting question as to what constitutes the so-called "febrile puerperium" which, in itself, has become an indication for a repeat cesarean section. The proponents and opponents of repeated sections differ most widely on their interpretation of the significance of the previous puerperal course. As indicated here, the morbidity from cesarean section approaches 50 per cent but the percentage of rupture of the scar is relatively low. If the definition of febrile puerperium is strictly adhered to, few patients will have a spontaneous delivery after once having had a section.

TABLE XV. FETAL MORTALITY, 6.9 PER CENT

	NUMBER	WITH SECTION	WITH VAGINAL DELIVERY
Deadborn	18	11	7
Stillborn	2	7	3
Neonatal	10	2	

The fetal mortality rate of all deliveries was 6.9 per cent. Following vaginal delivery it was 5.8 per cent, and after cesarean section, 7.2 per cent. As shown in Table XV, there were 18 deadborn, 2 stillborn, and 10 neonatal deaths. The 11 deadborn infants occurring among cesarean section cases were attributed to asphyxia, caused by premature separation of the placenta, placenta previa, or ruptured uteri. Among the 7 deadborn infants occurring in the vaginal delivery group, 3 deaths were caused by maternal disease (syphilis, erythroblastosis, acute yellow atrophy) 2 from prolapse of the cord, and 2 in which the cause was unknown. Seven of the neonatal deaths which occurred following cesarean section were caused by such conditions as intracranial hemorrhage, erythroblastosis, prematurity, atelectasis, pericardial effusion, and mongolism. Those following vaginal delivery were caused by intracranial hemorrhage and prematurity accompanied by congenital defects.[2] The stillborn deaths were attributed to asphyxia, though the cause was not clear in either case.

There were three maternal deaths among our series, a mortality rate of 0.67 per cent. They are reported briefly as follows:

CASE 1.—A 40-year-old para ii, gravida iv, who had a section with her first pregnancy because of premature separation of the placenta. This was followed by a full-term spontaneous delivery. She was admitted in the thirty-seventh week of the present pregnancy with acute yellow atrophy of the liver. As soon as the diagnosis was established a bag induction was successfuly used, but the patient was moribund during labor and expired shortly afterwards of hepatic failure. This death obviously had no relation to the method of delivery.

CASE 2.—A 40-year-old para ii, gravida iv, who was a mild diabetic, had had a difficult midforceps delivery with her first pregnancy, followed by a classical section in her second pregnancy which was performed on the indication of a large baby. A repeated section was performed with the present pregnancy because the previous puerperal course was not known. Following section, the patient had a postpartum hemorrhage which failed to respond to tamponade of the uterus and shock therapy.

CASE 3.—A 40-year-old para i, gravida ii, whose first pregnancy had been terminated by a Latzko section, the indication being desultory labor and maternal exhaustion. In the present pregnancy she delivered a premature infant spontaneously, but when signs of moderate hemorrhage and profound shock developed postpartum, the uterine cavity was manually explored. She developed signs of intrauterine infection and peritonitis on the following day, and on the twenty-fifth postpartum day died with signs of an overwhelming septicemia, acute endocarditis, and cerebral embolism.

In this case, the shock following delivery seemed somewhat out of proportion to the blood loss and a possible rupture of the uterus was seriously considered. A careful manual exploration of the uterine cavity by three members of the senior staff definitely ruled out this possibility, but may have contributed to the intrauterine infection.

Discussion

Once a patient has had a cesarean section, statistics show that her chances of requiring another section are 58 per cent. This figure is modified somewhat by the original indication for section. If it was for a condition which is not present in the succeeding pregnancy, she has a 58 per cent chance for vaginal delivery. If, however, it was for disproportion, then there is only a 30 per cent chance. However, if she has had a vaginal delivery following a previous cesarean, then the probability of future vaginal deliveries is very much increased. At the same time, the converse is also true that, with more than one section, the chances of repeated section become greater. As we have shown, disproportion is a relative term and does not necessarily mean that it will be present in future pregnancies. There were few patients in whom we could dogmatically predict cesarean section. This point is well demonstrated by the figures on clinical pelvic measurements and x-ray pelvimetry. In most cases disproportion was modified by the powers of labor, position and size of the fetus, and pelvic architecture. It will readily be acknowledged that disproportion itself exerts an influence on the two former factors.

The great problem among patients with a previous section is the condition of the scar and the possibility of rupture. Careful attention should be paid to the scar at the time of operation or vaginal delivery for better evaluation of future pregnancies. We have found it very difficult to secure any knowledge about the scar before delivery. In only one-third of the patients who were operated on for this indication was any defect obvious. Yet in one-half of all defective scars noted, defects were suspected prior to operation. We feel that this is probably as accurate as one can be in the evaluation of the usual patient. A febrile puerperium is important to keep in mind, as all of the cases where rupture occurred had a previous puerperal morbidity. It is well to realize that the infection does not necessarily have to be a severe one, as the majority of the patients had less than five days of a low grade (38° C.) fever. The fact that our morbidity following cesarean section is high (42 per cent) lends support to the opinion of those who advocate "once a section, always a section." The incidence of rupture of the uterus was 1.78 per cent (corrected 1.3 per cent) and is as favorable as any yet reported. The fact that there was no maternal fatality among patients with ruptured uteri was undoubtedly due in great part to careful observation and prompt treatment. Ruptures occurring early in labor had a low fetal mortality while those occurring later carried almost 100 per cent mortality for the fetus.

Conclusions

1. The termination of 445 viable pregnancies following cesarean section are reported.

2. The majority of previous cesarean sections had been of the classical type (57 per cent).

3. Fifty-eight per cent of the patients in this series had a repeat cesarean section. The greatest number of repeat sections occurred in the group where disproportion had been the indication for cesarean section (68 per cent).

Among patients in whom the original indication was no longer present in the succeeding pregnancy, it was lowest (42 per cent).

4. Once a patient had had a vaginal delivery following cesarean section, the greater was the probability of future vaginal deliveries. The converse was also true; the greater number of sections a patient had had, the less the chance of vaginal delivery. The greatest number of vaginal deliveries occurring in one patient following previous section was eight. The greatest number of sections performed on one patient was six.

5. In the majority of sections for disproportion, the indication is relative to the powers of labor, position, and pelvic configuration. This is demonstrated by both clinical and x-ray pelvimetry. For this reason, x-ray pelvimetry can rarely provide an absolute indication for section.

6. An unusually high incidence of abnormal presentations may be explained on the basis of poor pelvic architecture.

7. It is important to examine the scar of the previous cesarean section at the time of operation or vaginal delivery for better evaluation of succeeding pregnancies.

8. Defects in the uterine scar were noted more frequently following the classical type of section.

9. In one-half of the cases where there was a defect in the uterine scar, it was suspected prior to operation. However, in only one-third of the patients in whom section was performed on the indication of damage to the uterine wall, were any defects noted.

10. Rupture of the previous scar occurred in 1.3 per cent of the patients in this series. There were no maternal deaths among these patients; we believe this to be attributed to close observation and prompt action.

11. The high morbidity (29 per cent) is explained by the high operative incidence.

12. The fetal mortality rate was 6.9 per cent.

13. There were three maternal deaths, a mortality rate of 0.67 per cent.

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A COMPARATIVE ANALYSIS OF THE DIAGNOSIS AND TREATMENT OF ENDOMETRIOSIS, INCLUDING A REPORT OF FIFTY-THREE CASES OF INTESTINAL ENDOMETRIOSIS*

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IN A RECENT comparative study of the case records of patients operated upon for endometriosis by the entire staff of Presbyterian Hospital, with particular emphasis on those lesions involving the bowel, certain changes in general diagnosis and treatment were found that seemed of interest. These changes were noted by comparing the two previously reported[1, 2] groups numbering 569 patients with a more recent group of 317 individuals operated upon by the same surgeons during the last four years.

A definite yearly increase in the proportional number of cases operated upon has occurred (Table I). The rather sharp increase in incidence between the first and second studies was most probably due to the final acceptance of endometriosis as a major gynecologic entity, and the establishment of more accurate diagnostic procedures. This applies both to the resident as well as the attending staff. It was quite apparent at this time that all of us were becoming "endometriosis conscious." The increase in details of diagnostic importance in both the hospital and office records during this period is quite striking. Some of these patients have been operated upon almost entirely on the basis of an intelligent, carefully taken clinical history, without the usual palpatory pelvic findings being clear. The points in the history that seem to be of particular importance in this connection are often not voluntarily given by the patient unless the examiner elicits them by careful questioning (Table II). We refer particularly to the following symptoms:

1. Dyspareunia.

2. Pain in the rectum caused by passage of stool or gas. This pain is usually present only at menstrual time or at least intensified at that time.

3. Recurrent diarrhea coincident with the menstrual period (superficial bowel implants).

4. Symptoms of low grade bowel obstruction, such as nausea, cramplike pains, and constipation at period time (implants involving bowel muscularis or mucosa).

5. Unexplained sterility.

6. Extension of menstrual backache to the thigh and often lower leg.

7. Abnormally increased bladder irritability at menstrual time.

8. Low deep pelvic discomfort caused by jarring of the body, such as walking or riding in an automobile (Counseller[3]).

9. A history of an acquired dysmenorrhea appearing in a multipara or a change in the type of pain of the functional dysmenorrhea of the nullipara.

*Part of a symposium on Endometriosis before the Chicago Gynecological Society, May 19, 1944.

TABLE I

	ALLEN 1921-1933	HAYDON 1934-1940	THIERSTEIN AND ALLEN 1940-1944
Number of cases	112	457	317
Incidence	8.4%	13.1%	------
Ovarian function retained	90—88%	296—64%	260—82%
Hysterectomy			
Abdominal	82—73%	134 } 78%	75 } 63%
Vaginal	------	225 }	125 }
Resections	41	223	150
Mortality	1	0	0
Reoperation	6	0	3

TABLE II

	ALLEN 1921-1933	HAYDON 1934-1940	THIERSTEIN AND ALLEN 1941-1944
Symptoms			
Increased bleeding	79	422	216
Backache	48	179	88
Dysmenorrhea	48	226	114
Abdominal pain	25	70	27
Dyspareunia		70	27
Bowel pain	8	25	33
Associated Lesions			
Fibromyoma	46—41%	253—55%	133—42%
Others	--	243	97
Retroversion	--	81	62

10. Appearance of the symptom-complex or palpatory findings resembling those of pelvic infection in a patient over 35 years of age, since pelvic infection becomes progressively rarer during this decade of life.

11. Finding of blood in the stool at menstrual time which cannot be accounted for by the more common forms of rectal pathology.

The routine employment of combined rectovaginal examination of the pelvis has undoubtedly been responsible for more accurate diagnosis than any other item in our armamentarium.

Palpation by the rectal finger of a single tender nodule in the cul-de-sac may be the key which will unlock the door of diagnosis of many complicated pelvic problems. This fact is especially true if, in subsequent examination at the time of menstruation, a significant increase in tenderness or size of the identifying nodulation has occurred. For this reason, in our experience, it has been more satisfactory to conduct this examination in the unanesthetized patient. Exquisite "point tenderness" will often direct the examiner's attention to a minute nodule which would be overlooked in the anesthetized patient. If, on esthetic grounds, the patient or the doctor objects to an examination during the menstrual period, the day preceding the onset of the menstrual period seems to be preferable to the postmenstruum. The swelling and tenderness of the lesions is more marked during the period of congestion than during its regression. Preparation by a cleansing enema given the night before and repeated the morning of the examination has materially increased the ease and accuracy of palpation. In fact, this method of examination may materially change the

choice of surgical approach and preoperative prognosis in such conditions as fibroids, ovarian cyst, or retroversion of the uterus which so commonly complicate endometriosis.

Included in this series are a large number of patients who have been operated upon elsewhere for lower abdominal pain or intractable dysmenorrhea without relief. Endometrial lesions of varying extent have been overlooked or misinterpreted. The previous preoperative diagnosis in these patients has ranged from acute or chronic appendicitis, blood cysts of the ovary, retroversion of the uterus, hemorrhoids, pelvic inflammatory disease, uncomplicated fibromyomas, to stenosis of the cervix. Twenty-seven per cent of those patients with endometriosis of the bowel had had appendectomies within the last five years, and, of these, 60 per cent had no relief from recurrent attacks of lower abdominal pain. Two patients had surgical procedures for hemorrhoids with no relief of rectal pain.

Every effort should be made to give endometriosis its proper place in the diagnostic armament of the general surgeon, internist, endocrinologist, urologist, and physician in general practice.

Endometriosis is a progressive, adhesive, penetrating lesion and may require much more destructive surgery, such as castration, than that necessary in myomectomy, suspension of the uterus, resection of ovarian cysts, or even complete hysterectomy for fibromyomas (Table III).

TABLE III

	ALLEN 1921-1933	HAYDON 1934-1940	THIERSTEIN AND ALLEN 1941-1944
Location of Lesions			
Ovaries	60	345	162
Uterus	53	313	142
Cul-de-sac	--	191	80
Ligaments	--	69	89
Bowel	4	22	22
Peritoneum	16	--	19
Tubes	--	16	12
Bladder	3	3	1
Appendix	1	1	2
Vagina	-	-	1
Abdominal	3	3	1
Rectovaginal septum	37	-	16

The widespread distribution of the lesions of endometriosis coupled to their infiltrating propensities may make preoperative prognosis very hazardous. Comparatively small endometrial lesions intimately involving adjacent important structures, such as the rectum, bladder, or ureters, may indicate removal of the ovaries rather than the lesions themselves. However, the loss of only one patient in a group of 886 patients may indicate that we have been too radical in castration and too conservative in resecting lesions involving the bowel.

We do not believe, from a postoperative study of those patients in whom ovarian function has been retained and who are now free of symptoms, that definite conclusions can be drawn concerning the need for total excision of widespread nodules of endometriosis. Many of these patients are symptom-free, and

some have conceived and borne children, although they still have definite endometrial islands left in the pelvis. It is our impression, therefore, that at least in young women desirous of pregnancy, a supreme effort should be made to conserve ovarian function, although only partial removal of the endometrial tissue may be possible (Table IV). Subsequent x-ray castration is usually accepted more gracefully by the patient if symptoms should persist or recur than is primary institution of the surgical menopause.

TABLE IV

	ALLEN 1921-1933	HAYDON 1934-1940	THIERSTEIN AND ALLEN 1940-1944
Fertility—Taken from histories with adequate marital data			
Number of cases	88	262	185
Sterility			
Absolute	53—60%	168—63%	113—61%
Relative	18	134	--
Number of known pregnancies following operation	8 of 30	19	14

For the sake of keeping the symptomatology more uniform, we have divided our cases of intestinal endometriosis into two main groups. The first group consists of those having endometriosis involving the rectum, the second consists of those having the lesion higher up in the intestinal tract. There are 41 cases in the group involving the rectum. Twenty have the endometriosis within the layers of the rectal wall, while the remaining twenty-one have lesions adjacent to the rectum with adhesions involving the serosa. The location of the twenty-one lesions is as follows: rectovaginal septum, 6; cul-de-sac of Douglas, 7; sacrouterine ligament, 7; and left broad ligament, 1. There are twelve cases with endometriosis higher up in the intestinal tract with the following organs involved: sigmoid, 6; cecum, 3; ileum, 1; appendix, 2.

TABLE V. SYMPTOMS OF 41 CASES WITH RECTAL LESIONS

Lower abdominal pain	34
Rectal pain or pain with bowel movement	26
Dyspareunia	14
Backache	13
Constipation	9
Pain radiating down thigh	8
Menorrhagia	8
Diarrhea	6
Nausea or vomiting	5
Pelvic pressure	3
Fainting spells	3
Gas and generalized distress	3
Blood in stools	2

The admission complaints of the patients having rectal lesions are listed in Table V. Some patients had several complaints, so the total number of complaints is larger than the number of patients. The complaints in every case were exaggerated just preceding or during the first part of the menstrual period. The longer the duration of the condition, the longer the symptoms continue after each period. In some cases of long standing, the patient finally arrives at the

point where abdominal pain is constant throughout the month. If, however, a history of the onset of the condition is obtained, the symptoms will be confined to the menstrual time. In our series, the length of time the patient waited before coming for treatment or before being diagnosed was three months to ten years. There is a marked variation in how rapidly the pain becomes progressively worse.

TABLE VI. SYMPTOMS OF 12 CASES WITH LESIONS PROXIMAL TO RECTUM

Lower abdominal pain	12
Nausea and vomiting	6
Rectal pain	5
Constipation	5
Gas and generalized distress	5
Menorrhagia	4
Epigastric pain	3
Acute obstruction	3
Backache	2
Pelvic pressure	1

The admission complaints of the group with intestinal endometriosis proximal to the rectum are listed in Table VI. Here, as in the other group, the symptoms are more pronounced during menstrual time. Those developing symptoms of acute bowel obstruction suffer exacerbations at menstruation. The lesion may obstruct the lumen of the bowel, causing it to be reduced to a minute size. In this group, there were three cases with acute obstruction. Two were operated upon by the general surgical service with the mistaken diagnosis of carcinoma and a loop of bowel resected. The third case was diagnosed preoperatively as endometriosis by combined roentgen and pelvic examination. Surgical castration was done, since the bowel was not totally obstructed. This patient rapidly regained normal gastrointestinal function and has gained fourteen pounds in weight.

Our discussion thus far has dealt with the symptoms of intestinal endometriosis, the cases being divided into those of the rectum and those proximal to the rectum. The lesions should again be divided into two separate groups in regard to the histologic findings and also with respect to how these histologic findings influence the clinical symptoms.

Pathologically, intestinal endometriosis may be of the superficial type or it may be of the deep type. The superficial type is by far the most common, and is also the least dangerous clinically. On gross examination, there is a dark puckered area seen grossly on the serosa. On palpation it is a hard nodule varying in size from a buckshot to a bean. Histologically, one finds an island of tissue with endometrial-like glands surrounded by endometrial-like stroma within the layers of the serosa itself. The deep type appears grossly similar but it is larger in size; together with its adhesions it may form very large masses. It is hard and indurated on palpation. Histologically, the deep type is seen as the same endometrial islands as the superficial type, but it is confined largely to the muscular layer of the bowel. In some cases, the serosa and mucosa are entirely intact and the muscularis alone is involved. The Behrendt-Neumeyer case[4] is an excellent example of both superficial and deep intestinal endometriosis.

This case came to autopsy, and one obstructive lesion with the endometriosis confined to the muscularis and many superficial lesions confined to the serosa were found. Clinically, the symptoms of the superficial lesions is pain, etc., without obstruction. The deep lesions, on the other hand, are likely to sooner or later cause a frank obstructive picture. A number of cases[5-18] of deep intestinal endometriosis have been reported in the literature, and many of them have the lesion only in the muscularis. A brief clinical history, operative procedure, and pathologic report of two cases of intestinal endometriosis operated upon by the general surgical service and included in this report are as follows:

CASE 1.—A. G., aged 49 years, gravida i, para i. The patient complained of pain in the right lower quadrant for two months, increasing constipation for six months, menorrhagia and dysmenorrhea for two years, and a loss of fifty pounds in one year by diet, from 200 to 150 pounds.

The physical examination was essentially negative. The pelvic examination revealed a uterus enlarged to twice the normal size, moderately fixed, and tender on motion. Roentgenograph showed a filling defect in the upper sigmoid suggesting a neoplasm. A laparotomy was done, and a tumor of the sigmoid found tightly adherent to the uterus, left tube, and ovary. The entire mass was removed, delivering uterus, left tube, and ovary, and resecting a portion of the sigmoid. The liver was normal and no enlarged lymph nodes were found.

Histologic examination: The section of the sigmoid showed the serosa not present due to adhesions. There were islands of endometrial-like tissue throughout the muscular layer and one island in the submucosa. The mucosa was intact.

The patient made an uneventful recovery and later a successful closure of the colostomy was done.

CASE 2.—F. R., aged 33 years, gravida i, para i, complained of pain in the left lower quadrant for one year, severe at last two periods, dysmenorrhea for one year, pelvic pressure relieved by bowel movement for two months, gas and belching for one week. She had had an appendectomy and resection of cysts on both ovaries five years previously.

On physical examination, fullness in the left lower quadrant and acute tenderness were found. The preoperative diagnosis was ovarian cyst. At laparotomy there were found: a cyst of the left ovary 9 cm. in diameter, and a hard constricting tumor on the sigmoid 3 cm. in diameter, having a puckered surface. A biopsy of the sigmoid was done and the tissue found to be cartilage hard. The frozen section was questionable so a Mikulicz type of resection was done. The patient made a good recovery.

Histologic examination: The section of the sigmoid showed the mucosa intact. There were islands of endometrial-like glands, surrounded by endometrial stroma in the muscularis, submucosa, and subserosa.

The diagnosis of the ovarian tissue was a typical chocolate cyst.

In reviewing the histologic sections described in the literature and the cases in our own hospital, one would feel inclined to believe that both of the common theories[19-22] of the origin of endometriosis are necessary to prove all cases. Sampson's theory of retrograde menstrual flow through the tube causing peritoneal implants would account for the superficial lesions where the serosa is intact. The other theory of abnormal differentiation of celomic epithelium would more easily account for the deep lesions. All the organs, in which endometrioses have been found, developed originally from the celomic epithelium.

The endometrial lesions that cause obstructive symptoms will present characteristic roentgenologic pictures as reported by Jenkinson and Brown.[23] These are relatively long filling defects of four to seven inches, a sharp demarcation

of the filling defects, with other portions of the bowel showing little evidence of disease, an intact mucosa, and exquisite tenderness on palpation during fluoroscopic examination. Proctoscopic examination should be a regular part of this examination to help in the differential diagnosis of the malignant lesions of the bowel.

In carcinoma, the mucosa of the bowel is usually involved, the filling defect is short with sharp irregular margins. The constant filling defect is not usually as tender to palpation as is that of endometriosis.

The fundamental principles underlying the treatment of endometriosis are still undergoing a slow evolution from that of the previous radical procedure of routine castration to one of more conservative individualization. This evolution has come about largely through the efforts of men trained in the art of obstetrics as well as the practice of surgery. This group has led the way in efforts to retain or increase fertility as well as maintain function. Since endometriosis is a disease of the childbearing period and almost one-half of all cases of endometriosis are sterile or relatively so, conservative treatment is more desirable than in almost any other surgical condition. Further, evaluation of the fact that complete removal of all lesions or structures unnecessary for symptomatic or functional cure may lead to a still more conservative attitude in the future.

Several considerations have entered into our choice of procedure and methods of approach in the treatment of this series of patients. First is the extent and location of the lesions. Widespread lesions involving only superficial or relatively unimportant structures we have surgically removed or destroyed with the nasal loop cautery. Deep lesions, such as chocolate cysts and adenomyomas, have been resected in almost direct proportion to the patient's age and parity. Cauterization of the surface of deep lesions, when complete removal seemed too hazardous, frequently gave symptomatic relief. More extensive resection or removal has been carried out irrespective of the appearance of the lesion on the side of the pelvis in which the major part of the symptoms have occurred.

As far as we can ascertain, no one has satisfactorily explained the mechanism of pain in endometriosis. Minute lesions often cause the patient debilitating pain, while widespread involvement may occasion only slight discomfort. We have reserved x-ray castration for those patients in whom a surgical attempt has been made to correct the condition and in whom the histologic diagnosis leaves no doubt as to the benign nature of the lesion.

The vaginal approach, both as a diagnostic procedure as well as an avenue of treatment, has found increasing favor on our service. Many cases with small endometrial lesions have been operated upon at the proper time through the diagnostic use of posterior colpotomy rather than waiting until gross destructive lesions have appeared. One has much less hesitancy in advising a surgical procedure which is so safe and relatively painless as is colpotomy, to say nothing of the shorter convalescence required as compared with the simplest laparotomy. Small lesions lying at the bottom of the cul-de-sac or in the sacro-uterine liga-

ments, or even in the ovaries, may be treated per vaginam as accurately as through the abdominal incision. If hysterectomy is indicated and especially if repair of the perineal floor is also necessary, even more extensive endometrial lesions may be adequately cared for through the ordinary vaginal hysterectomy incision. In fact, some lesions, such as low-lying adenomas of the rectovaginal septum or ovaries fixed low in the cul-de-sac can be reached by vaginal approach more readily than through an abdominal incision.

If at any time during a vaginal operation removal or exposure of lesions becomes impossible, closure of the vaginal vault followed by abdominal incision will not appreciably increase the morbidity to the patient. Most gynecologic clinics do not hesitate to do ordinary vaginal repair followed by intraabdominal pelvic procedures. We do not feel, however, that the vaginal approach should ordinarily be chosen under the following conditions:

a. In patients whose clinical symptoms suggest involvement of the bowel.

b. For those patients in whom sterility is of first importance.

c. Grossly extensive lesions associated with fixation of organs.

d. In instances of fixed retroversion which cannot be easily reposed.

e. Where extraneous symptoms may indicate of themselves abdominal exploration.

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ASPHYXIA OF THE NEWBORN INFANT

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IN ORDER to contribute to reduction of the considerable death rate in the newborn infant, continued emphasis must be placed upon prophylaxis and treatment of cyanosis or apnea. In recent years a number of studies have been made upon the cause of this apnea. In 1941, we published a preliminary article[1] on our experiences in the resuscitation of the newborn infant, based upon 196 cases. Since then, 1,048 additional resuscitations have been effected and have made the following observations possible.

Asphyxia, or the better term, apnea, is defined as an interference with the oxygenation of the blood stream, or, clinically, it may be expressed as the lack of spontaneous effort to take a breath within thirty seconds after the cord is severed. After this period of time, definite cerebral changes will take place from anoxemia, and if oxygenation of the blood stream does not occur within one or two minutes, there will be definite permanent cerebral changes. Oxygenation before this time will overcome any changes which will have taken place.

Causes of Asphyxia

Most frequently the causes of asphyxia are found in the mother and in the handling of the mother during labor. These causes may be classified into two large general categories; those which occur before labor, and those which occur at the time of labor and delivery. In general, the prelabor group plays little or no part in producing asphyxia of any severe nature. However, it may be the precipitating factor added to any other cause, which may result in a severe asphyxia. In the category of causes occurring before the time of labor and delivery may be included such factors as:

Age of the Mother.—It is definitely known that an arbitrary line may be drawn at the age of 35. After 35, mothers are more likely to deliver an asphyxiated baby than they are prior to this age.

Parity of the Mother.—In general, primipara produce more asphyxiated babies than do multipara. This can be generally explained on the basis that more cerebral trauma is likely to occur in the baby of a primiparous mother than among those of multiparous mothers. However, in the multiparous mother, for some undetermined reason, the third, sixth, eighth, and eleventh babies seem to have a greater tendency toward asphyxia than do the others.

Profound anemia in the mother should be especially emphasized as, in practically all cases, any mother who has an anemia of less than 3,000,000 red cells, will usually give birth to a baby with less than 4,500,000 red cells, which in two or three days is quickly reduced to a level below 3,000,000. With this reduction of oxygen carrying power, naturally, cyanosis is quite liable to occur.

TABLE I. DISEASE CONDITIONS OF THE MOTHER

Cardiac disease
Kidney disease
Profound anemia
Diabetes mellitus
Tuberculosis
Syphilis

Causes at Time of Labor

The most important and numerous group at the time of labor and delivery must be considered in more detail. In most cases, two or three causes exist at the same time, and the combination produces severe or moderate asphyxia.

Duration of Labor.—It is becoming increasingly evident that the prolongation of labor is by far the most outstanding single cause of asphyxia of the newborn. It has been too easy to blame the analgesic drugs, but the asphyxia the drugs produce is by no means either as frequent or as severe as that produced by a prolonged labor.

In primiparous mothers, when the first stage of labor has been twelve hours, or the second stage of labor has been six hours, the incidence of asphyxia rises sharply. When the first stage of labor has passed sixteen hours, or a second stage of labor has passed eight to nine hours, over 80 to 85 per cent of all babies may be expected to be born asphyxiated. In the multiparous mother, the same is true, but the length of labor which may be endured without asphyxia in the first stage is only eight hours, and in the second stage only four hours. This seems paradoxical, for the multiparous mother should not be producing as much obstacle to the delivery of the baby as is expected when she delivered her first. However, in the multiparous mother, who has had relaxation of bone and ligaments, if delivery is prolonged, the effort to push the baby through the birth canal is so much greater than is normally expected that cerebral trauma ensues.

TABLE II. TYPE OF DELIVERY

TYPE OF DELIVERY	ASPHYXIA RATE	DEATH RATE
Version & extraction	80-90%	25-35%
High forceps	80-90%	25-30%
Breech extraction	60-65%	12-15%
Midforceps	50-60%	10-12%
Cesarean sections	85-95%	8-10%
Low forceps	15-25%	3-5%
Spontaneous delivery	10-20%	2-3%
Low forceps with episiotomy	10-20%	1-3%

The above figures point out many interesting facts. They definitely show that the more traumatic the type of delivery, the higher the death rate and asphyxia rate. The amount of analgesia necessary during labor, and the depth and type of anesthesia necessary, all contribute to produce asphyxia; consequently the type of delivery is not the sole cause. However, in many cases, the type of delivery will produce a cerebral hemorrhage to the extent that asphyxia will occur.

It is interesting to note the asphyxia and death rates in cesarean sections. In many cases, physicians have proceeded to do a cesarean section with the belief that they were protecting the baby by giving it a better chance for life. This is far from being the truth. In a previous study at Touro Infirmary in New Orleans, it was found that the average death rate in cesarean sections, when no intratracheal catheterization had been done, ranged from 9 to 10 per cent. The average death rate, when intratracheal catheterization was performed, was lowered to less than 2 per cent. Studies on those babies who died without having had proper resuscitation revealed some very interesting details. They lived on an average of 17 to 21 hours, with ranges of from 4 to 47 hours. Their clinical course was quite strikingly the same. In most cases they breathed spontaneously, or after a few minutes breathed without a great deal of stimulation. They remained pink and breathed rhythmically for a period of two to three hours, after which time they turned suddenly cyanotic. Each was revived with a little difficulty, and usually placed under oxygen, whereupon the baby remained pink and breathed easily for a period of another few hours. Suddenly it turned cyanotic again and was revived with even more difficulty than previously. This time under oxygen it did not breathe rythmically. After several more hours, the baby turned very definitely cyanotic and with a slate gray appearance remained so, breathing with more difficulty. The respiration would then become more shallow until death occurred on an average of about 18 hours after birth. Pathologic examination of these lungs revealed that those alveoli which had been opened were lined with pseudo membranes consisting of amniotic fluid, meconium, lanugo, blood, and other detritus commonly found in the upper respiratory passages of a newborn baby. This, therefore, may be termed a pneumonia due to the aspiration of amniotic fluid. It has been too frequently termed congenital atelectasis of the newborn. It is not an atelectasis. It is truly an aspiration pneumonia.

It has been commonly known that the average baby born from cesarean section does not breathe as spontaneously or as quickly as a baby delivered by other methods. Reasons for this have never been definitely determined. The squeezing action on the lungs and head produced by the passage through the normal birth channel is probably the major stimulus for the baby to breathe. However, this does not seem to be the full truth. In our experience, the average cesarean section baby will not breathe spontaneously within the conventional time limit of thirty seconds previously mentioned. In such cases, it is extremely necessary that a routine intratracheal catheterization be done. When catheterization is performed, 3 to 7 c.c. of thick mucoid material is aspirated. In many cases, much more is frequently obtained from the trachea. In the average newborn delivered through the normal birth channel, aspiration of the tracheal passage usually yields about 1 or 2 c.c. of the same material. In comparing again the results obtained with routine intratracheal catheterization, as compared to no intratracheal catheterization, the death rate is strikingly different. In the former, out of 317 cases performed routinely, only six deaths occurred. This is a death rate of 1.8 per cent. During the same time,

137 cesarean sections with no subsequent intratracheal catheterization of the baby were observed with twelve deaths, a death rate of 8.7 per cent. This is too striking a coincidence to be disregarded. Here it is noted that of the six deaths, which occurred after routine intratracheal catheterization, five were autopsied and found to have massive cerebral hemorrhage. In the twelve deaths of those who did not have routine intratracheal catheterization, eleven were autopsied. The one which was not autopsied was found to be congenital atelectasis of the newborn and had a strikingly similar course to that described previously. Of the other eleven deaths, two died from cerebral hemorrhage, and nine died from aspiration pneumonia, previously described, having been regarded as either asphyxia neonatorum or congenital atelectasis of the newborn. In other words, ten out of twelve died, when probably these deaths were preventable. It is our very firm and definite conviction that, if a routine catheterization of the newborn be done at every cesarean section immediately upon delivery, the death rate can be reduced from an average of from 8 to 10 per cent to as low as 2 per cent.

Prepartal Analgesia.—In our previous paper, we presented a rather detailed discussion of most of the drugs used in obstetrics. We can add little or nothing to change any of the statements made at that time. Our observations on the use of morphine have been confirmed. A definite narcosis was noted within four hours. Morphine, therefore, should never be given where delivery is expected within four hours. Scopolamine has a definite cumulative depressing effect, if more than $\frac{1}{50}$ grain is given within a period of twenty-four hours. In general, the barbiturates have little or no effect on the baby unless such an amount is given to cause a depression in the mother. However, there is one notable exception to this, and that is the use of nembutal (pentobarbital sodium), which causes a very severe and profound asphyxia of the baby.

In our previous paper, attention was called to the fact that as little as $1\frac{1}{2}$ grains (0.09 Gm.) four to six hours prior to delivery has produced narcosis in the child. The effects of pentobarbital sodium begin to appear in the infant about thirty to forty-five minutes after the drug is taken by the mother, and they are long lasting, still being present six to eight hours after ingestion; the effects reach their height about two hours after ingestion and remain at a maximum for the next two hours. The infant born under the effects of pentobarbital sodium presents such a characteristic appearance that an observer familiar with the appearance may realize merely by looking at the baby that pentobarbital sodium has been given to the mother. The baby is a deep purple, limp, with absolutely no reflexes; he breathes with difficulty only after from ten to thirty minutes of intensive resuscitative efforts and then fails to maintain respiration well, repeated resuscitations being necessary before a regular rate of respiratory rhythm is established. The baby has several cyanotic attacks and cessations of respiration during the first twelve hours of life and needs close and careful attention, fails to cry at all for the first eight to twelve hours of life and is indifferent to all sorts of stimuli for twenty-four hours after birth. Even after respiration is well established, the purple color lingers

on the hands and feet for from twelve to twenty-four hours; the heart rate is rapid and the pulse is shallow; circulation appears to be poorly established.

The foregoing observations seem fully to justify the assertion that the use of pentobarbital sodium should be discontinued and that morphine should not be administered if delivery is possible within four hours. Greater reliance should be placed on the relatively harmless barbiturates.

Newer drugs since our previous paper include demerol, and we have been able to observe in the past year approximately 100 or 120 cases in which it was used. Little or no effect is noted on the baby when delivered. The use of caudal analgesia has been watched closely, and as is the experience of many others, no effect is noted on the baby to any great extent, that can be attributed to the effect of the drug.

Anesthesias.—Chloroform: This drug is not widely used in the United States, and has a severe depressing effect on the baby when used and, as its margin of safety is so small, it should be administered only by an experienced anesthetist.

Ether: This is probably the most widely used anesthetic in the United States, and has little or no effect on the baby that cannot be overcome rather easily.

Cyclopropane: Cyclopropane evidently should be given only by a very experienced anesthetist, as it seems to cause more trouble than any other gas anesthetic. Not only does it produce some asphyxia, but it seems to produce a secondary shock to the baby about four to six hours after it is delivered. We have noticed that babies delivered under cyclopropane anesthesia, some four or six hours later, have a little perspiration and their temperature is generally one to one and a half degrees lower than the average newborn, coexistent with a tendency to vomit, and suckle less than the average baby.

Ethylene: Ethylene seems to produce no effect on the baby of any great note.

Intravenous anesthesias are mentioned to be severely condemned for use in obstetrics. The death rate for both the mother and the baby is too high to consider their use in pregnancy.

Spinal Anesthesia: The added danger of sudden drop in blood pressure of the mother is a deterrent to the use of this particular technique.

Miscellaneous Causes.—Other factors may cause cyanosis of the newborn. Included among these are prematurity; premature separation of the placenta; bleeding placenta previa; short cord or prolapse; knot, kink, or compression of the cord in the mother. Prematurity is in itself such a notable cause of asphyxia that it must be especially mentioned. However, its prevention is a matter to be considered with that of preventing the delivery itself, and not that of preventing asphyxia.

The foregoing are, in general, the major causes of asphyxia in the newborn. The recognition of them suggests the proper prophylaxis. Further emphasis must be placed on the fact that usually more than one cause exists to initiate asphyxia in a newborn. No single factor, except cerebral hemorrhage, usually produces a severe asphyxia in a newborn.

Methods of Resuscitation

Asphyxia has been classified for a long time under two types: asphyxia pallida and asphyxia livida. These two are vague terms and mean nothing, as the average baby who is delivered severely asphyxiated may be of either color. A much better classification is that suggested by Flagg,[2] which is as follows:

Mild Asphyxia.—The infant resists movement of the head and limbs. Mucous plugs and amniotic fluid fill the mouth and pharynx. Muscle tone is good, conjunctival reflexes are present.

Moderate Asphyxia.—Muscle tone is absent. There is no resistance to opening the mouth. No reflex irritation is induced by aspiration or by stimulation of the glottis.

Severe Asphyxia.—The infant does not respond to attempts of resuscitation. He appears livid or pallid. There is absence of any respiratory movement, and only an occasional flicker of the cardiac impulse may be detected through the thoracic wall. The upper respiratory tract has become a collapsed tube. All reflexes are naturally absent.

The outstanding factors in this particular condition are the absolute listlessness of the baby; the very slow heart beat; and the definite appearance of a dead baby.

Principles of Resuscitation

In order to have any good resuscitation, four major principles must be followed. Each of the following principles is of equal importance and no technique of resuscitation can lack any one of them and still be a good method of resuscitation. These are:

1. A minimum of handling.
2. Immediate warmth.
3. A clear open airway.
4. Oxygenation of the blood stream within 30 seconds of severing the cord.

The first thing necessary in resuscitating a baby is to avoid severing the cord until it has ceased to pulsate. Cutting the cord as soon as possible deprives the baby of 80 to 200 c.c. of very necessary blood, and if it has a tendency to asphyxia, it is consequently deprived of from 25 to 30 per cent of its oxygen carrying power. As soon as the cord has been severed, the baby should be received into something warm and put down upon a flat surface immediately. With the use of an intratracheal catheter, the nose is first aspirated. This is a very powerful reflex toward the stimulation of respiration and in the case of mild asphyxia, may alone be sufficient to initiate respiration. However, if the baby has shown no attempt to breathe, the mouth, gums, under the tongue, lips, cheeks, and nasopharynx must be aspirated. If the baby shows no attempt to breathe, the catheter is then gently introduced about one-half inch into the trachea which is aspirated first, and then by means of the resuscitator's own breath through the catheter and bulb, the chest is gently inflated and allowed to deflate by its own elastic recoil, at a rate of from 24 to 30 times per minute. It is only necessary to inflate the chest sufficiently

to cause the chest wall to start to expand. Further inflation may cause damage. Deflation is not necessary, as the elastic recoil of the lung will provide its own expiration. After this has been done for a short time, and if oxygen is available, the baby may be given pure oxygen by means of one of the better resuscitators, if it is on hand at a hospital.

Probably the best resuscitators available today are the Ericson and Johnson and the Henderson machines. These provide definite pressures of oxygen. In the case of the E. & J., there is mechanical deflation, while in the Henderson machine, there is no deflation, the elastic recoil of the lung doing its own work. However, if no machine is available, it is only necessary to continue inflation of the lung by means of the resuscitator's own breath. This is frequently as effective as any machine. As soon as the baby has taken a few breaths, and has started even a short rhythm of respiration, it is given 100 per cent oxygen, preferably. This may cause a slowing up of respiration, but will result in deeper breaths, and inflation of the lungs to a greater extent producing a better rhythm of respiration. The use of 5 per cent carbon dioxide and 95 per cent oxygen is very good, but it seems to cause, in many cases, a cessation of the rhythm which has been previously established. The use of stimulating drugs such as alpha-lobeline, coramine, metrazol, caffeine-sodiobenzoate, adrenalin, seem to have little or no beneficial effect. After respiration has been established, the use of coramine in dosages of four to six minims may help the heart rate, and possibly aid the rhythm of respiration. However, this is doubtful, and any reliance on stimulating drugs is depending on a broken reed. Alpha-lobeline is strongly advocated as an excellent method of resuscitation. Our experience is that drugs have no value—actual aspiration and subsequent insufflation of the lungs is the truly reviving technique.

Aftercare

The aftercare of the newborn resuscitated baby is of equal importance to that of the resuscitation itself. Too frequently this is overlooked. Such a baby must be treated as if he were very sick, and as if he were a premature baby. The following instructions should be followed:

1. The baby should be placed in an incubator at approximately 90° F.
2. Oxygen should be given continuously for at least six to twelve hours.
3. Careful observation of the baby must be made every fifteen or twenty minutes, if he has no special nurse.
4. No feeding is offered for the first twelve to eighteen hours.
5. Coramine (dosage minims 4 to 6) may be given at thirty-minute intervals, if the heart beat seems to be too slow, or if the respiration seems to be flagging.
6. Carbon dioxide, 5 per cent and oxygen, 95 per cent should be given as inhalation for one to two minutes every thirty minutes for the first six hours to aid in deeper respiration and to inflate more alveoli.

The above aftercare is much more important in those babies which have been severely and moderately asphyxiated than in the milder cases. Every case must be individualized, and the above orders must be changed as circumstances warrant.

The results obtained by the application of the principles which we have found to be effective in the recognition and relief of asphyxia in 1,048 additional newborn infants to the 196 previously reported have been analyzed, and our observations are tabulated as follows:

TABLE III. RESULTS OF RESUSCITATION

TYPES OF ASPHYXIA	NO. OF CASES
(a) Mild	471
(b) Moderate	420
(c) Severe	157
	1,048

TABLE IV. LENGTH OF TIME NECESSARY TO INITIATE RESPIRATION

Less than 5 minutes	812
5-10 minutes	139
10-15 minutes	36
15-30 minutes	27
30-60 minutes	17
1-2 hours	10
2-3 hours	2
3-4 hours	4
4-5 hours	1

TABLE V. RESULTS OF RESUSCITATION

Unable to start respiration	1
Respiration maintained less than 1 hour	4
Respiration maintained longer than 1 hour but less than 4 hours	15
Respiration maintained longer than 4 hours but less than 24 hours	49
Respiration maintained longer than 24 hours	979

TABLE VI. DEATHS

Infants with mild asphyxia	3
Infants with moderate asphyxia	14
Infants with severe asphyxia	52

TABLE VII. CAUSES OF DEATH

Prematurity	29
Intracranial hemorrhage	29
Malformation	4
Erythroblastosis foetalis	2
True congenital atelectasis of newborn (pneumonia alba)	3

Discussion

Anoxemia, from many causes, is responsible for 18.5 per cent of all deaths in newborn babies. It is fourth in the causes of death in this age group. Among the most frequent contributing factors of anoxemia are the age and parity of the mother, duration of labor, type of delivery, prepartal analgesia, and the anesthesias used during delivery. Less frequently, prematurity, premature separation of the placenta, bleeding placenta previa, short cord, pro-

lapse, torsion, knot, kink, or compression of the cord may cause it. Anoxemia prolonged more than two minutes after delivery will cause serious cerebral changes. But the prompt initiation and maintenance of respiration within thirty seconds after cutting the cord will prevent these changes, and if it is established before two minutes it may oxygenate the blood sufficiently to arrest any changes which have begun.

Consequently, it is absolutely necessary for anyone accepting the obligation of caring for the newborn, whether he be the obstetrician, pediatrician or general practitioner, to familiarize himself with the causes and treatment of asphyxia in the newborn, if any reduction is to be made in this preventable cause of death, which contributes so largely to the death rate of newborn babies. The death rate among the newborn has not been reduced in the same proportion as it has been in other age groups in early life during the past forty-five years. Continued study and close observation will enhance our knowledge so that we shall more effectively lower the percentage of this cause of death in newborn babies.

Conclusions

The results of the study of 1,048 additional cases of asphyxia to the 196 previously reported are analyzed and tabulated.

The prenatal and natal predisposing causes of asphyxia, the means of preventing them, and the basic principles and methods of resuscitation are discussed.

More general appreciation and recognition that it is necessary to be alert to any delay in the spontaneous initiation of respiration in all newborn babies immediately after birth is suggested as an urgently indicated preventive measure to reduce the high death rate from anoxemia.

The acquisition of the knowledge necessary to safeguard all newborn babies from asphyxia and treat them if it occurs, is an obligation which must be assumed by everyone who accepts the responsibility for the care of the newborn.

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PRECONCEPTIONAL PROGESTIN THERAPY IN HABITUAL ABORTION

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MANY of us concerned with the problems of sterility are given credit for therapeutic triumphs which are not rightly ours. According to our present concepts and contrary to lay opinion, any young vigorous female who has been impregnated by an equally young vigorous male faces a fairly considerable chance of spontaneous abortion of a "bad egg," the pathologic ovum which Nature usually suspects, inspects, and discards in the first trimester of pregnancy. Should this patient then consult a "sterility expert," and should she go through a subsequent pregnancy normally under his guidance, credit usually goes to the doctor rather than to the patient's statistical chance of maintaining instead of discarding the fertilized ovum.

The acid test of any therapeutic plan for improving the statistics of lost ova lies in the treatment of the so-called "chronic or habitual aborters."

The subprimate mammals show a 30 per cent ova loss, as determined by the discrepancy between the number of corpora lutea and the number of embryos in the litter. These investigations in the sow and oppossum indicated that of the ova ovulated, three in ten either defied fertilization or, if fertilized, soon ceased to develop and were then absorbed with no recognizable evidence of pregnancy remaining therefrom. Figures in human fertility have been difficult to come by.

Mall[22] found that 48 per cent of his entire collection of abortions were pathologic. Hertig[13] found 46 per cent of his series were pathologic, accepting as a "pathologic ovum" one which could be demonstrated either grossly or microscopically to be deficient in development. These ova cannot be separated into true primary germ plasm defects or into ova which, though inherently good, undergo an aberration of development due to defective secundines, inadequate circulation, poor implantation, and to local or general causes. The final common denominator is the "pathologic ovum" which is a recognizable entity.

Mall[22] and Streeter[28] found that only one-fifth of the embryos aborted at the end of the first month were normal, whereas of those aborted in the close of the second month one-half were normal. In the third and fourth months, eight-ninths of the aborted fetuses showed no evidence of pathologic changes. In the latter half of pregnancy, abortions due to pathologic ova no longer are found. These premature labors are explainable on the basis of mechanical fault of the supporting structures, such as faulty implantation, faulty placentation, inadequate maternal circulation or abnormal uterine irritability. Monsters surviving to term represent anomalies too slight to cause spontaneous termination of pregnancy.

Pathogenesis of the Pathologic Ovum

Factors in the pathogenesis of the pathologic ovum are still controversial. A positive statistical correlation has been found between the occurrence of certain states and the occurrence of spontaneous abortion.

1. Defective germ plasm, the true "pathological ovum."

2. Nutritional states, such as avitaminosis, lack of food factors, and poisons.

3. Abnormalities of the generative tract, such as fibroids, infections, retroversions, and lacerations.

4. Incretory disturbances, such as disturbances of hormone production (pituitary, thyroid, ovary, adrenal, etc.) which manifest themselves in defective decidual reaction, genital hypoplasia, and adiposity.

5. Chronic system disease, such as syphilis, nephritis, toxemia, focal infection, undulant fever, endometritis, anemia, chronic passive congestion, and infarcts.

6. Trauma and fatigue.

It is extremely difficult to discuss the factor of defective germ plasm. If we accept the "inevitable human wastage" as about 10 to 20 per cent of all fertilized ova, then our concept is modified greatly. Malpas[23] studied 6,000 pregnancies, finding a spontaneous abortion rate of 18 per cent. Interpreting these pregnancies on a chance-variation basis, he reached the conclusion that chance factors were not ruled out until three successive abortions or stillbirths had occurred. In other words, recurrent factors could not be said to be in operation (so that abortion could be regarded as "habitual") until there had been three consecutive failures. With this in mind, one is loath to call the patient's hereditary constitution "defective" quite as readily as before. We can easily study the morphology of the male germ cells, and investigations show that an incidence of abnormal forms up to 20 per cent may be no hindrance to satisfactory reproduction. A higher incidence is associated statistically with an increased number of abortions. The female germ cells and their early fertilizations are extremely difficult to study, and therefore we have no comparable data in the female. Present work on the recovery of unfertilized ova from the abdominal cavity, the tubes, and the uterine cavity may give us additional information, and much has been learned of early embryonic life through the work of Streeter, Hertig, Rock, and others. Suffice it to say, that there is nothing specific at the moment which we can do about preventing defective germ plasm save general hygienic measures.

Accordingly, we may describe "defective germ plasm" as an intrinsic weakness in the cell, apart from any other factors which could affect it, rendering it unfit to carry out the formal succession of developmental events and causing the appearance of structural and functional defects. An important school of thought suggests that physical and environmental factors are more effective than is yet realized, that endocrine factors may be able to alter the physicochemical anatomy of the fertilized ova so as to produce ultimately pathologic ova. Ninety-six per cent of 46 tubal gestations studied by Mall[22] were abnormal, which is a much higher figure than can be accounted for in ordinary population samples. This suggests that the abnormal environment has played a part in the abnormal development of the ova. In lower forms of life as well, many anomalies such as spina bifida, anencephalus, and the like, can be produced artificially by stimulating eggs with various substances, for instance, by hypertonic salt solution, weak galvanic currents, or mechanical irritation.

Malpas,[23] in his interesting statistical study of 6,000 abortions, found that if the patient has had but one abortion previously, she has a 78 per cent

chance of not repeating it. If she has had two abortions consecutively, she has a 62 per cent chance of not repeating. If the patient had had three previous consecutive abortions, only 27 per cent of untreated patients will carry to term; and with four previous consecutive abortions, only 6 per cent would not repeat. *It is not until the patient has had three consecutive spontaneous abortions that random and chance factors can be excluded.* These, then, are the "chronic or habitual aborters" who constitute a formidable group for study in sterility techniques.

Physiology of Progestin

There is ample evidence that the glands of internal secretion are either directly or indirectly concerned with the inception and maintenance of pregnancy. Disturbances of such relationships may affect the continuance of pregnancy. It is suggested that in the human being the successful continuance of gestation depends in part upon the normal balance between estrogens and progestin. Present evidence indicates that before and during the attachment phase, these hormones are supplied by the ovary and later by the placenta as chief supply.

Several critical points must be passed before a pregnancy can be viewed in salubrious fashion. Should the patient have had persistent follicular activity with a consequent excess of estrogen prior to conception, the usual hyperplastic endometrium is a doubtful bed for nidation due to its glycogen-poor, infarcted, unsatisfactory pregravid state. Even though nidation should take place, its tenure may be short because of surrounding endometrial hemorrhages. The finding of excess estrogen in the body fluids in cases of inevitable abortion would suggest that the uterus might be refractory to the influence of the corpus luteum of pregnancy. Shute[26] feels that such an excess may leave the endometrium relatively impervious to the invasion tactics of the fetal trophoblast. Cases of uterine hypoplasia due to inadequate pituitary gonadotrophic and/or estrogen stimulation are obvious. However, repeated abortions with their endocrine barrage have been known to develop the genitals more effectively than the clinician's ampule.

The gonadotropins, as well as the estrogens, have been the subject of many studies, but none conclusively point the way for clinical attack. On the other hand, observations[8] in the animal point more conclusively to the role of progestin in early pregnancy, the so-called critical period for the habitual aborter. A progestin deficiency arising prior to implantation may be responsible for inadequate preparation of the endometrium. In the event of conception, the fertilized ovum finds the nidation bed unsuitable, and early death and resorption follow. In the rabbit, the fertilized ovum will not implant if the corpus luteum is removed shortly after fertilization has taken place. This can be prevented by the administration of progestin.[8] Where the deficiency arises after implantation takes place, the resulting impairments in myometrial blood supply, poor glandular secretion, and uninhabited motility of the uterus may cause either resorption or abortion depending upon the stage of pregnancy.

Browne, Henry and Venning,[5] on the basis of pregnandiol excretion in normal pregnancy and spontaneous abortion stress progestin deficiency as a cause

of abortion. This failure was prone to appear at the time of the transfer of progestin secretion from the degenerating corpus luteum of pregnancy to the placenta. This may be due to premature regression of the ovarian corpus luteum[3] or to late assumption of its role by the placenta. This should take place sometime between the tenth and fourteenth week. In certain cases it is found[12] that the corpus luteum will undergo premature degeneration in either the nonpregnant or pregnant state. The former has been indicated by specimens of supposedly progestational endometrium which have shown faulty maintenance. The latter has been known to take place even before implantation occurs.

Plan of Study

Some five years ago, the study was started using patients who had had three consecutive sequential abortions. This, according to Malpas' criteria, would eliminate chance or random factors as cause for abortion. In addition, it seemed that one agent and only one agent should be used in this group of patients since too many conflicting therapies would nullify the conclusions. Reports[9, 10, 11, 18] using thyroid for one or both partners, the vitamins, the gonadotropes, even the estrogens and androgens, have been published. Often a combination of these factors was used, making evaluation of any one agent even more difficult.

It seemed reasonable to attack the problem of repetitive abortion therapy from the standpoint of prevention, rather than to rely upon frantic treatment established after uterine bleeding and/or uterine cramps had established themselves. Since these latter evidences would suggest a pathologic ovum, it again seemed reasonable to plan for the prophylactic phase rather than for the therapeutic phase. In other words, our best opportunity to influence proper nidation is before the patient's first missed period, during the critical few days between fertilization of the ovum and implantation. Since progestin seems implicated more definitely than any of the other available hormones in development of proper progestational endometrium, in promoting adequate vascularity, and in quieting uterine motility, then it seemed that progestin supplied in large amount from the preconceptional period onward was a logical start.

Abundant laboratory investigation in these cases with bio-assay techniques have yielded results difficult of interpretation. Therefore, a simple, relatively inexpensive way for treatment of the office patient was sought. There were no laboratory studies done on these patients except the occasional test incident to investigating the good health of both partners. Both partners were given a routine of a balanced diet, adequate vitamin intake by diet, and accepted habits of rest, exercise, and the like as far as our present confused civilian life would permit. The husbands were of proved fertility, with sperm counts of 50 million or better, with no more than 20 per cent of abnormal forms. The female patients were shown to ovulate habitually by endometrial biopsy if suspicion of abnormal catamenia was raised. Tubal patency was not investigated unless indicated. Cervical erosion, adnexal or uterine tumors, malpositions of the uterus, all were corrected. They were an average group of clinic and private patients who showed only the wear and tear of repeated pregnancies.

It is difficult to determine the accepted amount of progestin which the patient should be given. Browne, Henry, and Venning[5] have found that 10 to 20 mg. of progestin are excreted daily in normal pregnancy. If this be taken to indicate the amount of progestin metabolized, it may be that at least 10 mg. must be given daily. Progestin injected is recovered in the urine within 24 to 36 hours, which would seem to delimit the duration of action of artificially given hormone. Less hormone may be given if the patient misses her period and is presumably pregnant. If the facilities are available, deficient pregnandiol excretion would suggest a possibly deficient corpus luteum.

The patient was taught to calculate her fertile period, beginning some eighteen days before flow was anticipated, and continuing through until the tenth day before flow. She was taught to give herself injections of 5 mg. of progestin every other day beginning the eighteenth day until flow supervened. No disorder of the usual menstrual cycle was encountered, although it is well to caution one's patient that the normal cyclical variation of menstrual flow is from two to five days. Exposure to pregnancy was started on the eighteenth day and continued every other day until the tenth day before flow. This forty-eight-hour respite had been considered necessary for the average male to regenerate an effective charge of sperm. The patient was cautioned to lie quietly on her back for an hour after exposure. No other variation of position, preliminary douche, etc., were recommended. Should the patient miss her flow, she continued her shots every other day until the beginning of the fourth month, and then every third day until fetal motion was felt. From thence onward, it was felt that placental sources had long since superseded artificial sources. The parenteral route was chosen for constancy of dosage and absorption. By the oral route, many times this dosage must be given. No individual sensitivity to the progestin shots developed, although the problems of carrier sensitivity and possible antihormone formation were considered.

A perliminary report[25] was issued several years ago which listed the results in 23 cases. This is a further elaboration of the series, with a slightly different routine than that originally outlined. A total of 63 cases has been collected. Of these, 54 had had three consecutive abortions, and nine had four or more abortions. The age varied from 19 to 41 years, and all were in good physical condition as far as could be determined. Of the total, eleven had had one or more previous living children, whereas the remainder had never had a living child. Interestingly enough, the incidence of so-called germ plasm defect (or pathologic ova) was much higher than a random population sample would show. In other words, in such a highly selected group of cases, we should expect primary germ plasm defects to run much higher than the usual 10 to 20 per cent. Figures will be given for each group.

Group I was composed of patients who had had three consecutive abortions. Fifty-four of the 63 cases fell into this group. Thirty-one of the 54 went on to deliver viable infants (28 weeks or better) although only 21 went to full term. Of the ten who did not go to full term, three infants died of prematurity and its problems, one of the infants was erythroblastotic with acute hydramnion in the mother. In other words, 31 of the 54 delivered viable children, with 28 infants surviving. This would give a percentage of 57.4 or, if we exclude the three cases losing their babies from problems of prematurity, the percentage would correct to 51.8. In Malpas' statistical sequence, this group of cases would expect a fetal survival of 27 per cent.

Of the 23 cases who aborted, the abortion calendar ranged from five weeks menstrual age to 25 weeks. The incidence of proved pathologic ova was 69.1 per cent, whereas the remainder were normal embryos with defective maintenance.

In Group II were nine cases who had had four or more consecutive abortions. Some of the Group I cases moved on to add to the statistics of this group. In this group, only four of the cases carried to viability, with one premature who survived and the other three being full-term infants. Of the five patients in this group who did become pregnant, but did not go to viability, two patients had normal embryos, all other cases having pathologic ova. The salvage rate in this group then was 44.4 per cent. Malpas' figures for an untreated group were an expected salvage of 6 per cent.

In Group III were a number of cases who had had sequential abortions, but who either became discouraged, or who did not become pregnant despite this routine. If the latter were the case, often additional agents were employed or specific treatment was needed, such as correction of tubal occlusion, treatment for achievement of ovulation and the like. These cases have not been noted.

Two case histories are recorded in more detail to illustrate peculiar problems. Case histories of successful outcome we all can duplicate.

CASE 1.—Mrs. W. W., a 31-year-old housewife, had one adopted child. She was seen first in 1942 with a story of three previous spontaneous abortions in the last five years. No examination of the embryo had been done at any time, but, because she had failed to go through more than the first three months, these were presumably pathologic ova. General examination was negative and evaluation of her reproductive system was normal. She had never experienced difficulty in becoming pregnant, nor did she in this, her fourth pregnancy.

She was started on the preconceptional routine, and after one period had no further bleeding. Pregnancy was confirmed, and she went along normally until approximately 17 weeks, when, without warning, she bled and passed what was an entirely normal embryo of that gestational age. The placenta was completely circumvallate, and the point of rupture of the membranes was at the margin of the placenta. This would suggest a shallow-implanted ovum in the lower uterine segment.

Not discouraged, she became pregnant again after a single period. This pregnancy went up to 22 weeks, with fetal motion present, and a fundus which reached to two fingers above the umbilicus. However, she aborted again. The embryo was normal and of proper gestational size, with a placenta which had the identical findings of the previous one.

Progestin was continued all through the last pregnancy in larger amounts than usual, and will be continued in any subsequent effort. Under treatment, she has extended the intrauterine maintenance of the ovum.

CASE 2.—Mrs. L. M., a 29-year-old housewife, had first a premature labor, resulting in the delivery of a female infant weighing over 3 pounds which survived. Her next three pregnancies resulted in spontaneous abortions during the first three months. Her doctor made no report on these embryos. She embarked upon the routine for her fifth pregnancy, and carried through to 31 weeks, when she went into premature labor and delivered a 3-pound 11-ounce female which survived. The placenta was completely circumvallate, but was implanted in the upper uterine segment according to measurement of the point of rupture of the membranes.

This infant, a normal child, died of pneumonia at seven months of age. The patient wished to become pregnant again, and, under the treatment, which had been stopped at fetal motion before, went up to 29 weeks, when she said she had felt no fetal motion for several days. Auscultation failed to reveal any fetal heart tones, but she was watched for another week to be certain. It was felt to be too early for x-ray changes to appear. During this waiting period, the patient went into rapid labor of less than an hour. She delivered a macerated fetus, whose accompanying placenta showed erythroblastotic changes on microscopic examination. The father was Rh positive, as was the infant, a male. The mother was Rh negative. Her previous infant which had survived to seven months had been a female and had not been Rh tested.

Because of the introduction of this serologic problem of Rh positivity and negativity, such studies as the one we have embarked upon are open to further question and modification.

Discussion

In working with these cases, it became apparent that this was no treatment for sterility per se. No apparent improvement in fertility index could be noted. In addition, no properly controlled hormonologic studies were carried out. A few of these patients had isolated observations, but none could be considered studied adequately. This was frankly a clinical study alone, using the facilities of an open clinic and the physician's office.

Possibly, because of the long-continued use of progestin, a number of these patients who spontaneously miscarried seemed to have increased blood loss from poor immediate contraction of the uterus as well as a prolonged period of involution. Since the therapy was discontinued at about mid-term in the

majority of those cases who carried to term, presumably uninhibited estrogen effect was operable at delivery, i.e., irritability of the uterus and subsequent proper involution. It might have been well to have added estrogen therapy in the cases of pathologic ova with inevitable abortion in order to prevent this slight problem. Practically, it seems hardly worth while, and it would have added another variable. No prolonged maintenance of a pathologic ovum or dead baby was noted as due to progestin inhibition of uterine motility.

It is additionally interesting that if these cases could be urged on to another trial at pregnancy immediately after a spontaneous abortion, the statistical chances of carrying that pregnancy seemed to be enhanced. Routine curettage was performed immediately after each spontaneous abortion to guarantee complete extrusion of all products of conception. If this is done, the large majority of patients ovulate about two weeks after the abortion. It may be that even an abortive effort may prime the reproductive system for further efforts. Certainly we all have seen hypoplastic genital organs enlarge over the course of repeated abortions.

Effort was made to determine whether the patients who went into premature labor had some explainable cause for this. Of the eleven who did go into premature labor, examination of the placenta showed that there was either circumvallate formation to varying degree, low implantation, or premature separation. In other words, it would suggest that premature labor had a definite mechanical causative factor. Can it be that proper nidation, in the upper uterine segment to the proper depth, is aided?

A number of patients developed pregnancy-like changes in the breasts under therapy. There was no disorder of flow, either in character or in cycle. However, the breast changes were so frequent that they could not be used reliably in the diagnosis of pregnancy.

With the advent of more exact knowledge of the Rh factor, such a study as this must be considered in an entirely different light than that under which it was originally undertaken. If the Rh problem proves to be of importance in sequential abortions, we still have no effective therapy to combat the serologic problems. True, if the anti-Rh titer rises, one may induce labor to avoid fetal death in utero. However, such a study as this must await more information from this new field.

Summary

A brief report has been prepared investigating the use of progestin alone in the treatment of habitual abortion. By definition, habitual abortion is limited to those cases who have had at least three sequential abortions. Effort has been directed to the preconceptional phase of pregnancy, rather than to attempt to delay or to prevent abortion once it is threatened. This has been a clinical and statistical report, without adequate hormonologic control. It is a small series of cases, and so is subject to further investigation in much larger groups of cases. Results are encouraging.

There is no reason that this regimen should not be applied to any patient who has had a previous spontaneous abortion, whether progestin is used alone

or in combination with other agents. However, one should be extremely reluctant to give or to accept credit for the successful outcome of that subsequent pregnancy.

Appreciation is expressed to the Schering Corp., Bloomfield, N. J., for generous experimental supplies of parenteral and oral preparations.

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THE ORAL USE OF HEXESTROL FOR ESTROGEN DEFICIENCY

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MANY of the synthetic estrogenic substances which have been discovered are found to be effective when taken orally. One of these preparations, diethylstilbestrol, has been given extensive clinical trial; others are being accepted and prescribed with increasing frequency. It seems certain that, in the future, additional estrogenic drugs will be produced by chemical synthesis.

Outside of their common quality of being estrogenic, these artificial hormonal drugs differ not only in their qualities of potency, absorption rate, and duration of effect, but in the degree and type of their toxic reactions. The latter untoward manifestations are receiving intensive study at the present time, and hexestrol, a synthetic estrogenic substance,[4, 5, 7] was found to cause fewer and milder detrimental effects than diethylstilbestrol. Hexestrol proved to be especially beneficial in the treatment of the menopause patient who is relieved of hot flushes and many other climacteric symptoms.[1-3, 6, 8-10, 16-18]

Ninety patients suffering from the menopausal syndrome were treated with hexestrol for the purpose of making a clinical comparison with other orally administered natural and synthetic estrogens. Previously, 502 patients had been treated with either diethylstilbestrol dipropionate, estradiol benzoate, or estrone;[12] 138 patients were given conjugated estrogens-equine;[13] 47 patients and 80 patients were observed while using ethinyl estradiol and alpha-estradiol, respectively.[11] Thus, the effects of various estrogenic substances were observed on 857 patients and a clinical comparison was made with the 90 patients treated with hexestrol.

The hexestrol* used in this study consisted of uncoated 0.2 mg., 1 mg., and 3 mg. tablets. These tablets were scored so that they could easily be broken into two equal parts. Whenever possible, the daily dose was divided so that the substance could be taken more frequently, that is, two or three times daily.

The efficacy of treatment with hexestrol was judged by the amount of clinical improvement noted. As the hot flush was considered to be the outstanding characteristic of natural or artificial menopause, the duration, frequency, and intensity of this symptom were considered to be the most important factors in determining the degree of improvement. After this, all the other symptoms, including laboratory tests showing evidence of estrogen deficiency, were considered. Sedatives were not administered during treatment.

Clinical Material

Of the 90 patients treated with hexestrol, there were 32 patients with natural menopause (climacteric), 25 with artificial menopause, and 33 with other conditions and an associated ovarian deficiency. A few of these patients had preliminary hormone assays made of the urine.[14]

The patients in the climacteric period ranged in age from 38 to 59 years, and, of these, 16 were still menstruating, 3 regularly.

*The hexestrol tablets were obtained from The Wm. S. Merrell Company of Cincinnati, Ohio.

The ages of the patients with artificial menopause varied from 29 to 63 years. Bilateral oophorectomies had been performed on 6 patients, subtotal hysterectomies on 6 patients, and oophorohysterectomies on 9 patients. One of these patients was treated with radium because of metrorrhagia and to produce artificial menopause; 2 others were treated with x-ray therapy, and a fourth patient had x-ray therapy preceding bilateral oophorectomy.

Thirty-three patients with other conditions associated with ovarian deficiency were aged 15 to 46 years. This group included the following conditions: secondary amenorrhea, 5 patients; primary amenorrhea, 1 patient; oligomenorrhea, 7 patients; menorrhagia and metrorrhagia, 3 patients; dysmenorrhea, 2 patients; congenital absence of sex organs, 2 patients; frigidity, 1 patient; sterility, 1 patient; and hypoplastic breasts, 3 patients. There were 7 patients with psychoneuroses, and one with psychosis who had been given hexestrol as a therapeutic test to rule out estrogen deficiency as a cause of the symptoms.

Results

Table I shows the relief obtained from symptoms of the natural menopause with the largest dose of hexestrol used. Many patients were given medication that differed quantitatively from the dosage administered to others and the percentage of relief was estimated for each one. The varying doses which afforded the same percentage of relief were added together and the sum divided by the number of patients treated. In this way, it was possible to obtain the average daily dose required to give the percentage of relief indicated in Table I.

Table II shows the symptomatic relief obtained in the artificial menopause patients with the largest daily dose used.

Table III shows the improvement obtained in estrogen deficiency symptoms in other conditions, and Table IV shows the largest dose given to each patient.

TABLE I. NATURAL MENOPAUSE

Per cent improvement	20-40	50-60	75-85	90	100
Average dose (mg.)	0.4	0.7	1.5	1.6	2.3
Number of cases	2	3	8	6	13

TABLE II. ARTIFICIAL MENOPAUSE

Per cent improvement	0	20-40	50-60	75-85	90	100
Average dose (mg.)	0.2	0.5	0.8	1.5	2.1	2.5
Number of cases	2	1	3	5	5	9

TABLE III. OTHER CONDITIONS

Per cent improvement	0	20-40	50-60	75-85	100
Number of cases	12	6	4	3	8

TABLE IV. OTHER CONDITIONS

Largest daily dose (mg.)	0.2	0.4	0.6	0.8	1.0	2.0	3.0	6.0	9.0	12.0
Number of cases	6	1	4	1	6	1	4	1	5	4

Some of the beneficial results observed after treatment with hexestrol were manifested in improved secondary sex characteristics. Patients noted greater fullness and tenderness of their breasts or that the nipples were more sensitive. A few patients stated that there was an increase in vaginal moisture and secretion. Vaginal smears during effective treatment disclosed an improvement in vaginal cell cornification. Several patients experienced increased libido; one patient declared that the tablets were "too sex stimulating."

Toxic Reactions

The unfavorable reactions due to hexestrol therapy varied with the dosage. They appeared while six patients were taking the drug, as follows: nausea and anorexia with 1.0 mg., none with 0.25 mg.; nausea with 4.5 mg., none with 1.2 mg.; nausea with 1.0 mg., none

with 0.5 mg.; nausea and rash with 12.0 mg.; asthenia and rash with 1.0 mg.; and rash with 1.0 mg. The latter reaction came on after two months of medication. The dosages given above constituted the total daily dose for each patient.

There were two questionable reactions. One patient complained that 0.4 mg. caused facial acne, and another patient stated that hexestrol became "too stimulating" to the nervous system. This latter patient had taken 0.5 mg. for six months and, at the time of her complaint, examination showed that she did not require further medication.

The incidence of toxic reactions was not very high, since there were but 6 of the 90 patients who experienced unfavorable effects from treatment with hexestrol (6+ per cent). When the dose was decreased, three of the patients having nausea became symptom free. The other three patients developed a rash and treatment was discontinued, but they might have been able to tolerate smaller doses of hexestrol with beneficial results. However, with the above method, the treatment was discontinued in 3+ per cent of the patients.

The toxic symptoms that did occur were very mild, did not interfere with the patient's routine activity, and disappeared a few days after treatment was discontinued. No morbid sequence or evidence of permanent harm was observed; none of the patients developed a malignant growth during the period of observation.

Menstruation

There was one patient with primary amenorrhea, one with oligomenorrhea due to delayed puberty, five with secondary amenorrhea, all of whom improved, and fairly regular catamenia were established. Hexestrol was used for its estrogenic effect, and then pregneninolone (oral progesterone) was given, 5.0 mg. daily to each of the seven patients. The respective dosage of each of the seven patients differed as follows: hexestrol, 3.0 mg., 6.0 mg., 6.0 mg., 9.0 mg., 9.0 mg., 12.0 mg., and 12.0 mg. daily. Both pregneninolone and hexestrol were given during the last half of the menstrual cycle, but in some instances hexestrol was given from the fifth to the twenty-fifth day, and the pregneninolone from the eighteenth to the twenty-eighth day of the cycle. Although these patients showed some evidence of estrogen deficiency, it is possible that menstruation might have been established after therapy with pregneninolone alone.

In one patient, menorrhagia and metrorrhagia improved with the 1.0 mg. daily dose; and in two patients, one with severe cramps, the 9.0 mg. daily dose was efficacious. Hexestrol was given to these three patients from the fifth to the twenty-fifth day of the menstrual cycle. A patient with metrorrhagia took 12.0 mg. of hexestrol daily, but the bleeding persisted.

The menstrual changes were considered undesirable in five patients who were taking approximately 1.0 mg. of hexestrol daily. The treatment produced oligomenorrhea in two patients who had previously been normal, whereas the third patient menstruated four days late with severe cramps. In a fourth patient with hitherto regular menses, the medication induced prolonged bleeding, whereas the fifth patient experienced a scanty menses lasting one week, although she had not menstruated previously for six years. This last patient was the only one of eighteen patients in the natural menopause in whom bleeding was produced.

Discussion

Hexestrol was effective when administered orally. Its use thus obviated the disadvantages of hypodermic medication.[15] It was a potent estrogen and relieved the patient of hot flushes and other menopausal symptoms; furthermore, it was used successfully as a therapeutic test to differentiate menopausal hot flushes from the vasomotor instability and diaphoresis of the psychoneurotic woman.

Satisfactory relief of climacteric symptoms was obtained with hexestrol in 1 to 2 mg. doses per day in the average patient in this series. Some patients required a larger dose, while others were relieved with 0.5 mg. Crotty, Schloss,

and Lyford[6] stated that the usual maintenance dose was 1.0 mg. daily. However, Freed[9] and Greenhill[10] believed that 2.5 mg. to 5.0 mg. was a satisfactory daily therapeutic dose.

Hexestrol, like diethylstilbestrol, was inexpensive and, in most patients, could be used in the place of the latter drug, thus cutting down the incidence of toxic reaction and the frequency of ensuing amenorrhea or undesirable uterine bleeding. However, when the inhibition of ovulation or the production of endometrial proliferation and withdrawal bleeding was considered desirable, the use of either diethylstilbestrol, ethinyl estradiol, or possibly conjugated estrogens-equine was considered the medication of choice.

Comparison of Estrogens

During the past few years, several natural and synthetic estrogenic substances were tested on groups of women[11-13] and the various effects produced by these substances when administered orally were studied. Although all these drugs relieved the patient of menopausal symptoms and produced the changes in the secondary sex characteristics typical of estrogenic therapy, they varied somewhat from each other both quantitatively and qualitatively.

As an example of the quantitative differences, the minimum dose giving effective relief of menopausal symptoms ranged as follows: ethinyl estradiol from 0.02 mg. to 0.2 mg.; diethylstilbestrol dipropionate from 0.2 mg. to 1.0 mg.; conjugated estrogens-equine from 0.62 mg. to 2.5 mg.; hexestrol from 0.5 mg. to 3.0 mg. In these doses the four substances were roughly equivalent in effect to each other. The majority of patients had about 75 per cent relief from hot flushes from the following doses; ethinyl estradiol, 0.07 mg.;[11] diethylstilbestrol dipropionate, 0.35 mg.;[12] conjugated estrogens-equine, 1.25 mg.;[13] and hexestrol, 1.5 mg.

Qualitative differences in the estrogenic substances were evinced by the untoward effects on menstruation as shown in Table V.

TABLE V. UNDESIRABLE MENSTRUAL EFFECTS

	HEXESTROL	CONJUGATED ESTROGENS-EQUINE	DIETHYL-STILBESTROL DIPROPIONATE	ETHINYL ESTRADIOL
Number of patients treated	75	118	157	37
Caused menstruation	1	15	5	5
Missed menstrual period	0	2	4	2
Per cent with above effects	1	14	6	18
Caused late, scanty, or profuse menstruation	4	7	information lacking	3

Only those patients having an intact uterus were included in the above tabulation. The uterine bleeding was considered undesirable because it was caused in patients who normally should not menstruate. Hexestrol was much less likely to cause or inhibit uterine bleeding than the other three estrogenic substances. The figures were low for diethylstilbestrol dipropionate because of the smaller doses used in the beginning when it was felt advisable to proceed with caution. Of course, withdrawal bleeding could have been caused with

larger doses in a much higher percentage of the patients. Reference is made to the papers previously published.[11-13]

Toxic reactions resulted in 3 to 6 per cent of the 90 patients in this series. Diethylstilbestrol dipropionate[12] and ethinyl estradiol[11] had a higher incidence of adverse effects, 10 per cent and 14 per cent, respectively. However, when smaller doses of ethinyl estradiol were given, there was a corresponding decrease in toxic manifestations. The toxic reactions caused by ethinyl estradiol were somewhat similar to those resulting from diethylstilbestrol dipropionate when given in equal therapeutic doses; however, they differed greatly when compared on a basis of weight. The estrogenic substances varied, inasmuch as conjugated estrogens-equine and some other estrogenic products caused no toxic symptoms.[12, 13] With each individual, the toxic reactions varied with the size of the dose; thus, when the dose was larger, the symptoms were correspondingly more severe. Many patients who had unpleasant symptoms from moderate to large doses tolerated small yet effective doses without consequent untoward symptoms. This modification was illustrated by the three patients suffering from nausea due to hexestrol who became symptom free when the dose was decreased to one-half or one-fourth of the original quantity.

A rough comparison, milligram per milligram, of the four most potent estrogenic substances used orally is made in Table VI.

TABLE VI. COMPARISON OF FOUR ORAL ESTROGENS

1 MG. OF EACH	HEXESTROL	CONJUGATED ESTROGENS-EQUINE	DIETHYLSTILBESTROL DIPROPIONATE	ETHINYL ESTRADIOL
Quantitative	Strong	A little stronger	3 to 6 times stronger than hexestrol	15 to 30 times stronger than hexestrol
Qualitative	Fairly good	Best	Fairly good	Good
Uterine bleeding	Very little	2 plus or more	3 plus or less	Strongest
Development of breasts	1 plus	2 plus or better	3 plus	Strongest
Relief from mental depression	2 plus or better	2 plus	4 plus	Strongest
Relief from hot flushes	1 plus	1 plus, a little stronger	4 plus	Strongest
Toxic symptoms	1 plus	0	More than with hexestrol	Most

Summary

Ninety patients with symptoms and conditions caused by estrogen deficiency were treated with hexestrol with satisfactory results. This substance had a strong therapeutic effect when given orally, and 1 to 2 mg. daily were sufficient to relieve the average patient of hot flushes. There was a low incidence of toxic reactions (3 to 6 per cent) without apparent permanent harm from the dosages used. The severity of the unfavorable effects, when they occurred, depended on the strength of the dose. The tablets were used also as a therapeutic test to help differentiate estrogen deficiency from other conditions.

Hexestrol shared with diethylstilbestrol the advantage of being inexpensive. It was suggested that this synthetic estrogenic substance would be more efficacious for the treatment of some patients than diethylstilbestrol.

A comparison was made with three other orally administered substances. It was found that the undesirable effects upon menstruation were less frequent with hexestrol therapy than with the other three substances.

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INTESTINAL OBSTRUCTION IN GYNECOLOGY

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INTESTINAL obstruction is encountered with a fair degree of frequency in gynecologic practice. A gynecologist should be an abdominal surgeon able to recognize and to deal competently with this condition. He should be able to do this himself instead of hastening at the first sign of trouble to cast his burden upon the shoulders of his colleagues in "general surgery." Such a course, common in many hospitals, is responsible for the amused and tolerant contempt with which the gynecologic service is regarded by many general surgeons, and it cannot fail ultimately to produce uncertainty in the minds of the laity. It is as true in this day of narrow specialization as when the words were first uttered that: "The man who opens an abdomen should be competent to deal with any condition that he may find within it." The gynecologist engaged in abdominal surgery must know and accept its responsibilities.

Of the cases of intestinal obstruction seen on a gynecologic service, a small number will be admitted with obstruction which has not been correctly diagnosed. In the study of any new admission, a history of failure of the bowels to move for forty-eight hours, or even less if frequent vomiting is present, should make one conscious of the possibility of obstruction and make it necessary to rule this condition out before proceeding to further diagnostic effort. If, in addition to frequent vomiting, even moderate distention is present, together with colicky pain centering in any one abdominal area, loud gurgling peristalsis, and localized tenderness, the diagnosis is clear. An x-ray film showing varying fluid levels and dilated and contracted intestinal coils is pathognomonic, provided it is taken with the patient in the upright position, but should be merely confirmatory.

It is to be remembered that obstruction can result from severe pelvic inflammatory disease, from some pelvic tumors, and that malignancy of the pelvic colon is sometimes wrongly diagnosed as disease of the left adnexa. Patients may be admitted to the gynecologic service with other erroneous diagnoses but suffering from obstruction caused by postoperative adhesions, any tumor of the intestinal tract, or strangulated hernia, either internal or external. In the case of obstruction by strangulated hernia, the absence of history or sign of hernia does not entirely eliminate the possibility, as a strangulated Richter's hernia can produce intestinal obstruction without manifesting a single external sign of its presence.

While not so frequently as in former years, the gynecologist will still see postoperative intestinal obstruction and must be alert for its recognition. Generally well-understood measures of prophylaxis against this condition serve to keep down the number of such cases, but they will continue to occur. These measures are: first, the avoidance of operation in acute pelvic inflammatory conditions; second, during pelvic operations extreme gentleness in the handling

of abdominal viscera with avoidance of massive packs, a minimum of retraction, and all the little but mighty points that make up good abdominal surgery; third, the postoperative patient who vomits more than twice should have a gastric lavage with or without the use of an indwelling tube and suction apparatus. The lower left chest should be percussed at the end of twenty-four hours and, if tympany is found, and it frequently is as high as the sixth rib, a small-caliber tube should be passed through the nose to the stomach and a suction apparatus left attached for from twelve to twenty-four hours. This should be done even though the patient appears comfortable, as the presence of this sign indicates a high degree of gastric and small intestinal distention, and vomiting within a few hours is the rule. My own opinion is that many cases of adynamic ileus and at least a few of intestinal obstruction have been thus averted.

The development of postoperative intestinal obstruction must be suspected whenever "gas pains" become too frequent and persist in spite of measures which are ordinarily helpful. If the patient indicates a fairly definite point of maximum intensity of the cramp, this symptom fairly screams for attention. The development of vomiting, loud gurgling peristalsis, and tenderness complete the diagnostic picture. The x-ray, as mentioned above, is helpful, but cannot make the diagnosis alone. One must not be misled by the passage of small amounts of feces by enemas as this may merely represent the emptying of the bowel below the point of obstruction.

The diagnosis of this type of postoperative obstruction should be fairly easy. More difficult is the diagnosis of obstruction superimposed upon an adynamic or paralytic ileus. After any abdominal operation there is usually some mild degree of gaseous distention of the stomach and intestine. This is due to a temporary paralysis of the intestinal musculature caused by operative trauma no matter how slight. If this persists beyond a day or two the distension becomes marked and vomiting ensues. This is the condition known as the adynamic or paralytic ileus. A low-grade aseptic peritonitis may coexist. Mechanical obstruction will occasionally supervene by the development of obstructing adhesions at points of kinking, or even by volvulus. Active treatment of the paralytic ileus will usually prevent the development of obstruction, but, if it fails to do so, the classic signs will gradually manifest themselves and can be recognized by careful observation, the patient being examined every few hours. As long as the distention is uniform, as long as severe cramps do not occur, and as long as infrequent quiet peristaltic sounds are heard through the stethoscope, mechanical obstruction does not exist. The x-ray again is helpful, the distension being seen to be evenly distributed and the fluid levels being absent or slight and obviously without significance. Proper treatment of paralytic ileus is by the use of the indwelling stomach or duodenal tube and the suction apparatus, the use of external heat, and the administration of intravenous glucose and salt solution. Efforts to whip up the paralyzed intestinal musculature by the use of pituitrin, pitressin, prostigmine, and similar preparations are irrational and foredoomed to failure. Likewise, the ordinary enemas are not effective, although the siphon enema may be of some slight aid if it does not distress the patient too much.

A few broad and proved principles guide the treatment of intestinal obstruction. If the diagnosis is made within twenty-four or forty-eight hours of the onset of symptoms and the patient's general condition is good, without too much distention or obvious fluid loss, operation should be undertaken at once. If the diagnosis is made later, after distention and water and chloride loss have become marked, operation must be deferred until these conditions have been improved as far as possible. Intubation, suction, and intravenous normal salt solution must be used, and the last pushed to the point of insuring a satisfactory output of urine. The Miller-Abbott or other tube long enough to extend well into the intestine should be used. These measures may be continued only so long as there is definite improvement. In some instances, improvement under these measures may continue and the obstruction be relieved, a copious liquid stool announcing this happy result. This, however, can neither be anticipated nor relied upon, and the patient should be under close and continuous observation. Unless there is definite improvement within twenty-four hours, operation should be done. There is no justification for a complacent feeling that a patient with obstruction will remain alive indefinitely under intestinal intubation and suction. There is always grave danger that a patient under the most careful observation will quietly cease to improve and slip back rather suddenly to a condition of collapse and shock, and that death will occur.

In operating for the relief of intestinal obstruction, the guiding principles again are few and thoroughly tested. What is to be done must be done as quickly as possible and with as little trauma as possible. The patient is in no condition to withstand prolonged operative procedure, and the intestinal wall can seldom be relied upon to hold sutures. The point of obstruction is most quickly found by seeking the junction of collapsed and distended bowel. If the obstructing agent consists of a single band of adhesions which can be readily divided by the knife or scissors, the problem is quickly, easily, and safely solved. If, however, the obstruction is buried in a dense mass of adhesions, decision is much more difficult. In general, one should beware of trying to separate extensive adhesions involving thick, edematous intestinal wall by digital dissection. The viability of the wall of intestine obstructed for forty-eight hours is apt to be low, and it has the distressing habit of tearing if any force is used in its manipulation. If digital dissection is attempted, the effort made should be of the gentlest. As a rule sharp dissection only should be used. If adhesions too dense to be separated are encountered, or an annular tumor at the moment is inoperable, the problem becomes one of creating an opening between the intestine above the point of obstruction and the anterior abdominal skin. Where a section of intestine fairly close to the point of obstruction can be found with a wall sufficiently viable to hold sutures, this opening may be made by suturing a large-sized catheter into the bowel by two or three purse-string sutures, or by burying an inch or so of the tube in the wall of the bowel after the method of Mayo. The point of perforation of the rubber tube should be reinforced by omentum. The tube should be brought out through a separate stab wound in the abdominal wall.

If the obstruction has gone on to the point where none of these procedures is feasible, nothing is left save to exteriorize a proximal loop of bowel, close the wound around it, and hope that the patient will live long enough for an opening to be made in it in twenty-four hours or so later. In point of fact, she seldom will do so.

After any form of enterostomy, cecostomy, or colostomy has been done, the resultant decompression of proximal bowel may permit Nature to overcome the obstruction. In such a case, the fistula will usually close spontaneously. Where the obstruction continues, the decompression will permit a later, safer, and more deliberate operation to be performed with a still later closure of the fistula if necessary.

When strangulated hernias are encountered, reduction must be accomplished without any pull on the intestine whatever. If a small segment of absolutely gangrenous bowel is found, and the formation above it is in good condition, resection and anastomosis may be done. If there is extensive damage to the proximal bowel it should be dealt with as outlined above.

A few brief illustrative case reports follows:

CASE 1.—A paralytic ileus developed immediately after cesarean section. Mechanical obstruction was superimposed upon this a few days later. Intubation and suction were instituted. Improvement was prompt and rapid. In three days the obstruction had been overcome and there was a free fluid movement of the bowels. No further operative treatment was necessary.

CASE 2.—Mechanical obstruction developed after an incomplete abortion, due to infection and a tremendous pelvic exudate. Intubation and suction, together with an active sulfonamide attack on the infection resulted in a disappearance of all obstructive symptoms.

These two cases may be added to the already long list of cases of intestinal obstruction of recent origin wherein Nature, aided by decompression from above, sufficed to overcome the lesion. The outcome of the next case, however, was not so fortunate.

CASE 3.—This patient was seen at home after four months of intermittent partial obstruction. She had been completely obstructed for two days. The condition seemed intimately associated with a large pelvic tumor. She was removed to the hospital and intubation, suction, and the administration of large quantities of fluid were begun. Improvement was rapid and continuous, and all signs of obstruction disappeared. A week later operation on the tumor was attempted. A large abscess was encountered and drained. The origin of this could not be determined at the time. The patient recovered, but a fistula persisted in the scar and from this was discharged a mucopurulent material identifying the tumor as a pseudomucinous cystadenoma of the ovary, as proved by later section. Time was allowed to elapse to enable her to regain her weight and strength, and reoperation was then advised. An attack of acute bronchitis supervened and necessitated further postponement of the operation. During this period she suffered another acute obstruction. Intubation and suction were again resorted to and she improved for thirty-six hours. She then suddenly went into a state of shock, acute circulatory collapse developed, coma ensued promptly, and she died six hours after the sudden change in her condition had become apparent.

This case illustrates the danger of persisting too long with nonoperative treatment. At some time this patient ceased to improve, and the fact was not

noticed until too late. Only under the most careful and continuous observation can conservatism be practiced, and even then disaster is always near.

CASE 4.—This patient had a moderate-sized ovarian cyst, but presented signs of acute appendicitis. Operation eight hours after the onset of symptoms revealed complete obstruction of the terminal ileum by a congenital fibrous band which formed what was in effect the neck of a hernial sac holding the terminal ileum and cecum. The band was cut and the cyst removed. Recovery was without incident.

CASE 5.—Postoperative obstruction occurred one year after operation. The patient was still in good general condition and operation was performed thirty-six hours after the onset of symptoms. Recovery was uneventful.

These cases illustrate the fact that if the diagnosis is certain and prompt, and the patient is in good condition, operation should be done at once.

CASE 6.—Two huge ovarian cysts, one as large as a full-term pregnant uterus, the other about a third as large, were removed from this patient. Her convalescence was stormy. Paralytic ileum developed promptly. Treatment by fluids, intubation, and suction was instituted. She apparently recovered from this attack, although there was always some degree of distention. On the sixteenth postoperative day signs of mechanical obstruction appeared. Operation was undertaken with what was thought to be a reasonable degree of promptness. It revealed that the condition had existed much longer than had been thought. An unsuspected annular carcinoma of the descending colon was found to be causing the obstruction. Almost complete gangrene of the proximal intestine existed. A too-prolonged and totally unsuccessful attempt was made to deliver the tumor into the wound with the idea of exteriorizing it. A hasty cecostomy was then performed. The patient stood the procedure badly, and died three days later.

In this case the diagnosis was too long delayed, although seemingly made as soon as the symptoms were apparent. Too much operative treatment of damaged bowel was attempted. Cecostomy should have been the only procedure, and it should have been hurried as much as possible.

CASE 7.—This patient suffered from recurrent attacks of partial and complete obstruction lasting two or three days at a time for a month before entrance to the hospital. A mass was palpable in the left adnexal area, and a diagnosis of ovarian carcinoma with involvement of the sigmoid was made. At operation an immovable carcinoma of the rectosigmoid was found with the ovary not involved. Colostomy was performed. Three months later the abdomen was again explored and the tumor removed. Anastomosis was not possible. The patient was living and comfortable eighteen months later, although it is hardly to be hoped that she is permanently cured.

CASE 8.—This was similar to Case 7, except that at the second operation it was again found impossible to remove the growth. This patient died two weeks after the second operation.

Patients with intestinal obstruction from malignant disease of the rectosigmoid will occasionally be encountered on a gynecologic service because of an erroneous diagnosis of left adnexal disease. The gynecologist must know that the same guiding principles apply in the treatment of these cases as govern the treatment of obstruction from any other cause, with the addition of course of the general principles of the treatment of malignancy elsewhere in the body.

Summary and Conclusions

1. The gynecologist is engaged in the practice of abdominal surgery.

2. He should be prepared to accept the responsibilities of that practice and to deal adequately with its complications. To do otherwise is to cast discredit upon the specialty.

3. The recognition and proper treatment of intestinal obstruction is a responsibility of every individual who makes an abdominal incision.

4. A discussion of the diagnostic points and general principles of treatment of this condition has been made.

5. Strict adherence to these principles will do much toward keeping the mortality from intestinal obstruction to a minimum.

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AN EVALUATION OF THE HOGBEN PREGNANCY TEST

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THE Hogben pregnancy test, based upon egg extrusion in the South African clawed toad (*Xenopus laevis*), has been extensively used, especially in the British Empire, since the reaction was first described by Hogben[1] in 1930. Of some 5,300 tests reported by six[2-7] different observers, the percentage accuracy is stated to be between 96 and 100 per cent. However, as experimental material was used by a number of investigators, no true idea can be obtained from these figures as to the accuracy of the test for routine clinical purposes. In order to obtain such a clinical evaluation, the results obtained with the Hogben test on 157 cases presenting diagnostic problems have been analyzed. An analysis of the 157 tests performed in the present series shows that they may be classified according to diagnosis in the following manner: 60 intrauterine pregnancies, 11 abortions, 2 ectopic pregnancies, 1 abdominal pregnancy, and 68 nonpregnant cases with miscellaneous diagnoses.

The method used was that described by Weisman[8] and, briefly, involves concentration of 40 ml. of the first morning urine by acetone precipitation and the injection of 1 ml. of the aqueous concentrate into the dorsal lymph sac of the toad. Early observers used as many as 10 animals to a test. A single toad per test has been used in the present series. Ovulation occurs and eggs are extruded in from eight to sixteen hours following an injection of a specimen containing a sufficient concentration of chorionic gonadotropin. Injections are usually given in the evening and observations made the following morning. This is in order to allow the animal to remain in darkness overnight, as it has been found that light sometimes inhibits egg extrusion.[9] A month is allowed as a resting period for each animal after a positive test, and two weeks following a negative. Landgrebe,[6] who has had a vast experience with these toads, has used the same animals over a period of twelve years and finds no loss of sensitivity to stimulation. His records also show that each animal in his colony is used approximately ten times a year.

Sixty-eight tests were performed to exclude the diagnosis of pregnancy under the following conditions: amenorrhea associated with obesity, myomata uteri or tuberculosis, corpus luteum cysts, ovarian tumors and functional irregular vaginal bleeding. Negative responses were obtained in all 68 instances and proved to be correct in the 56 cases adequately followed. The fact that no false positive tests were obtained is in keeping with the findings in the literature for, in the 5,300 tests reported, no false positive result has as yet been recorded. Landgrebe,[6] however, has found experimentally that a positive test can be obtained with the urine of menopausal women if the gonadotropic titer is high. This fact should be borne in mind for the interpretation of individual tests.

Sixty tests were performed on patients on whom the final diagnosis of normal intrauterine pregnancy was made. Forty-six were positive and 14 negative. Forty-one of the 46 positive tests were proved correct by follow-up studies;

the remaining five were so classified on presumptive evidence. There were no positive tests reported before the fortieth day of the pregnancy, as counted from the first day of the last menstrual period.

Eleven of the 14 false negative cases have been adequately followed, while three have been diagnosed on presumptive evidence. An analysis of these tests shows that seven, and possibly eight (Cases 1, 2, 3 [2 tests], 4, 5, 6, and 7 [1 test]) were performed when the duration of the pregnancy was under 40 days (Table I). One of these cases gave a positive rat test* although only 24 days past her last menstrual period; one had a positive Hogben test when repeated on day 40; and one had a positive Friedman and rat test on day 37; one case showed a positive rat test at day 45, one week after the negative toad test, but even at this date the value was only 130 I.U. of chorionic gonadotropin per liter of urine. Seven negative tests were obtained on patients who were more than 40 days past their last menstrual period. Of these, one showed a positive Friedman test at day 69. This patient was a 45-year-old Negro woman whose youngest child was 10 years old. On physical examination she was thought to be pregnant, but no follow-up has been obtained. One case, tested at 72 days, also had a negative rat test. This patient has since delivered approximately on her expected date of confinement.

TABLE I. TABULATION OF DATA ON CASES GIVING FALSE NEGATIVE TESTS

CASE	DAY OF PREGNANCY	REMARKS	FOLLOW-UP
1	24	Positive rat test (urine)	Delivered
2	35	Positive rabbit test Positive rat test 30,000 I.U./liter (serum) 37 days	Delivered
3	30-40? 50-60?	Irregular menses	Fetal heart heard at about 4½ months
4	37		Delivered
5	38	Positive toad test 40 days	Delivered
6	38	Positive rat test 130 I.U./liter (urine) 45 days	?
7	39 53	Positive toad test 76 days	Delivered
8	44		Delivered
9	45		?
10	69	Positive rabbit test	?
11	72	Negative rat test (urine)	Delivered
12	88		15 cm. fetus at hysterectomy

In an attempt to explain the 14 false negative results, we might say that seven, and possibly eight, tests were performed before day 40 of the pregnancy; the urinary chorionic gonadotropin is not high enough at this stage of pregnancy to give consistently positive results. An additional number of poor results can be accounted for by individual animal sensitivity. It must be remembered that a single toad per test has been used and, had it been possible to use

*Delfs, E.[10] The test, as originally described, measures the international units of chorionic gonadotropin per liter of blood serum by the uterine weights of immature rats. It has been adapted to urinary assays where indicated in the present study.

even two animals to a test, the results would no doubt have been improved. Case 10 is perhaps an example of this type of error as the Friedman test done at the same time was positive. Another source of error to which the test is subject is the irregularity of the chorionic gonadotropin titer in the urine. This accounts for a number of false negative tests which we have considered unavoidable and affects the Friedman and Aschheim-Zondek tests as well as the Hogben. Cases 6 and 11 illustrate this point. Case 6 showed a urinary titer of only 103 I.U. per liter at day 45 when the titer is expected to be 4,000 I.U. per liter or above by the techniques used.[10] Case 11 had less than 750 I.U. per liter at day 72 when the titer should be 10,000 or above. Excretion of chorionic gonadotropin varies widely from individual to individual and from specimen to specimen in the same individual. Although it roughly parallels the blood serum gonadotropin, it does not do so exactly (Table II). The factors controlling this difference are those concerned with the metabolism or detoxification and the excretion of the hormone, and extraneous factors which destroy it in the urine after excretion.

Such errors can be obviated by using the Delfs serum technique. In our experience, no pregnancy test based upon urinary excretion of chorionic gonadotropin approaches those based upon blood serum concentration in accuracy or sensitivity. In theoretical support of such an opinion, a chart has been made showing the average serum gonadotropin values in 23 normal pregnancies compared with actual serum and urinary gonadotropin values in two early pregnancies (Fig. 1). The disadvantage of the serum technique is that it is more time consuming.

TABLE II. COMPARISON OF RELATIVE CHORIONIC GONADOTROPIN VALUES IN BLOOD AND URINE, TWO CASES

CASE	DAY OF PREGNANCY	CHORIONIC GONADOTROPIN IN INTERNATIONAL UNITS* PER LITER	
		BLOOD	URINE FIRST MORNING SPECIMEN
I	70	54,880	25,020
	76	38,620	5,290
	84	16,920	5,120
	91	40,700	2,656
II	50	43,680	10,580
	57	22,080	21,860
	64	37,000	2,500
	71	20,740	4,420
	78	9,700	
	84	11,340	610
	110	5,190	390

*Delfs, E.[10]

In these two groups of cases we find that of 108 tests performed and adequately followed, 11 proved to be incorrect. All of these were false negative responses. No false positive tests were obtained. This gives an over-all percentage accuracy for the Hogben test of approximately 90 per cent. However, if all cases tested under the fortieth day of gestation are eliminated, this figure is raised to 96 per cent, which is closer to the accuracy obtained with experimental material.

Eleven Hogben tests were performed on 10 cases of abortion (Table III). Six of these were positive and five negative. Two of the five negative tests were

performed on completed abortions and one on a patient who had been bleeding two days and completed her abortion the following day. The rat test performed on the same day was positive. One case had a negative toad test at day 38, while a rat test performed on the blood serum was positive. This patient miscarried at six weeks. The fifth case had a negative Hogben and a negative rat test at day 52; both tests were positive by the seventy-eighth day, and the patient miscarried on day 114.

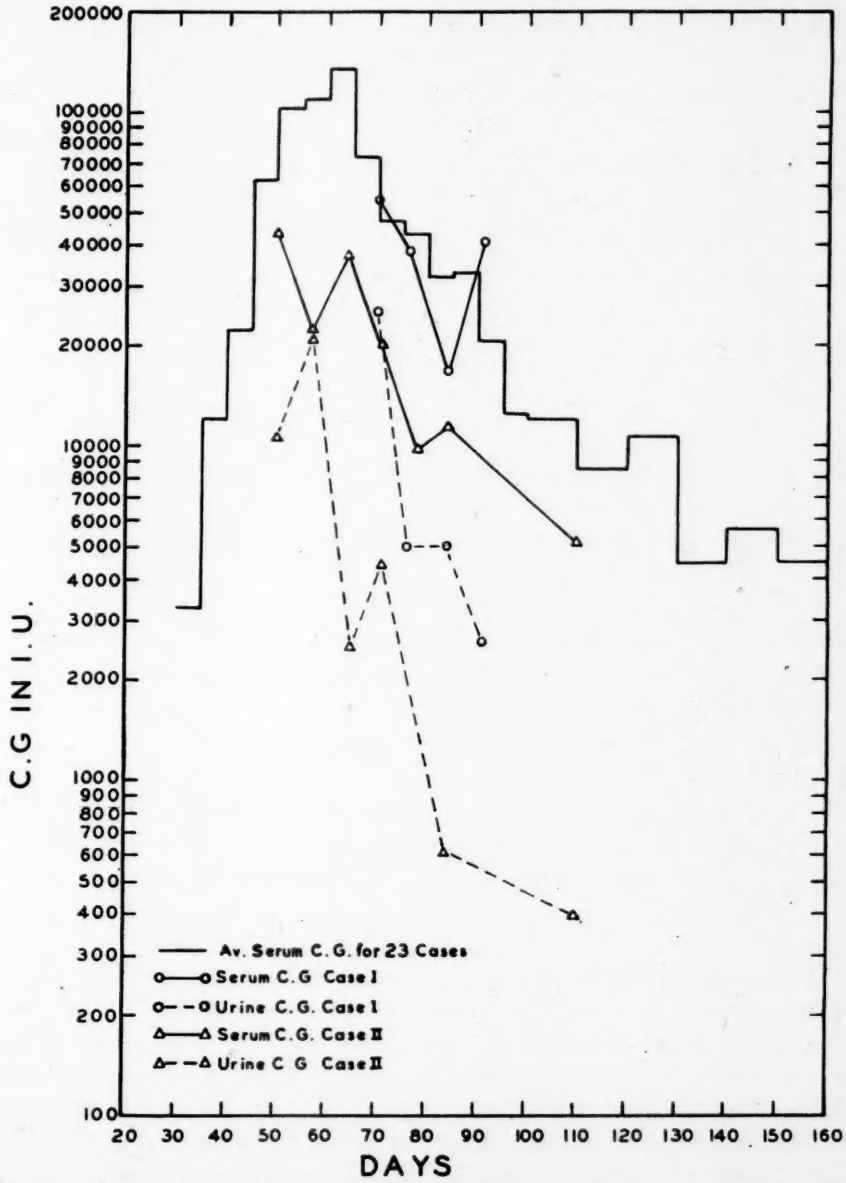

Fig. 1.—Average serum chorionic gonadotropin values for 23 normal pregnancies compared with actual serum gonadotropin and urinary gonadotropin values in two women. The chorionic gonadotropin is expressed in international units per liter of serum or urine plotted on a logarithmic scale. The days of pregnancy are calculated from the first day of the last menstrual period. The urine used represents the first morning specimen.

TABLE III. TABULATION OF DATA ON ABORTIONS AND EXTRAUTERINE PREGNANCIES

CASE	POSITIVE	NEGATIVE	ABORTED	REMARKS
Abortions:				
13	87 days		155 days Fetus not macerated	Bleeding throughout
14	120 days		128 days No recognizable fetus	Bleeding throughout
15	57 days		64 days	Gonococcal cervicitis
16	(Jan. 1-18) 3½ months		(Jan. 1-24) 3½ months	
17	? days		? days	
18		Positive rat test 1,230 I.U./liter (serum) 37 days	77 days	
19	78 days	Negative rat test (urine) 52 days	114 days	
20		Positive rat test More than 740 I.U./liter (urine) 57 days	59 days	Bleeding at time completed
21		66 days	63 days	Completed abortion
22		46 days	45 days	Completed abortion
Ectopic Pregnancy:				
23	69 days			Ruptured
24		156 days		Dead
Abdominal Pregnancy:				
25		Negative rat test (urine) 164 days		Placenta partially detached Baby alive—963 Gm.

Only two ectopic pregnancies have been studied. One had a positive Hogben test and acute clinical symptoms. This patient was 69 days past her last menstrual period. She was operated upon immediately and a ruptured ectopic pregnancy was found. The second case had a negative Hogben test and the clinical symptoms were minimal. She was 156 days past her last regular menstrual period. Two months after the negative toad test she was operated upon because of persistent pain, and a resorbing tubal mass with an organized pelvic hematoma was found. Microscopic examination of the tubal mass showed the presence of the hyaline and shadow chorionic villi.

One case of abdominal pregnancy studied gave a negative Hogben and rat test. At operation the placenta was almost completely detached; this may explain the low urine chorionic gonadotropin values. The placenta, however, was normal in appearance, and the baby lived eight hours.

Conclusions

In conclusion, it would seem from the present study that a normal intrauterine pregnancy cannot be diagnosed by the Hogben test with any accuracy before the fortieth day of gestation. Following this period the expected accuracy approaches 96 per cent. Approximately two-thirds of threatened or incomplete abortions will give positive Hogben tests. Cases of corpus luteum cysts, suspected of being ectopic pregnancies, give negative reactions.

These results are comparable with those obtained with the Friedman test and show the Hogben test to be a satisfactory one for clinical use. The most important clinical advantage of the Hogben over the Friedman test, aside from technical superiority in the laboratory, is that it gives no false positive results.

Animals were obtained from The Jay E. Cook, Xenopus Importer Company, Baltimore, Md.

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Addendum

Since writing the present paper an additional 100 tests have been performed with a 95 per cent accuracy. The Scott technique[5] was used in this group of assays and no test has been invalidated by death of the toad.

A POSSIBLE HEPATIC (HEPATORENAL) FACTOR IN GYNECOLOGIC MORTALITY

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ALTHOUGH it has been realized for a number of years that so-called "liver" and "liver-kidney" deaths (liver failure, hepatorenal syndrome) can follow any variety of surgery, not a great deal of attention has been paid to their possible occurrence after gynecologic operations. Heyd's[1] original report, in 1924, dealt chiefly with surgery of the biliary tract but mentioned liver failure after pancreatic and gastrointestinal operations. Since then, this type of death has been reported in association with intestinal obstruction, thyroid disease, and burns, and following such operations as radical mammectomy, splenectomy, and thoracoplasty.[2] Its occurrence after gynecologic operations, however, seems to have been mentioned only by Martin,[3] Connell,[4] and De-Courcy.[5] One of Connell's cases was an operation for ovarian cyst; the remaining cases were associated with hysterectomy.

The late Hilliard E. Miller,[6] in an analysis of 404 recent gynecologic deaths at Charity Hospital of Louisiana at New Orleans, called attention to a small group in which liver failure or the liver-kidney syndrome seemed to be responsible for the fatality. In an investigation of the postmortem material at the same institution for the years 1937 to 1940, inclusive, I have identified 10 deaths following gynecologic surgery, in which this cause seemed to be entirely responsible or in which the necropsy findings suggested that hepatic failure played an important part in the fatal outcome. A considerably larger number of cases of the same kind were discarded because the intrusion of other factors reduced the importance of the hepatic factor.

Analysis of Cases

Six of the 10 patients in this series were Negroes, whose respective ages were 27, 38, 41, 42, 48, and 58 years. The ages of the four white women were 26, 42, 43, and 47 years. All were submitted to hysterectomy, one by the vaginal route, four by the supracervical technique, and the remainder by the complete technique. Three operations were performed under spinal analgesia and the remainder under ethylene-ether anesthesia. Six operations lasted less than an hour; the others lasted, respectively, 90 minutes, 95 minutes, 2 hours and 5 minutes, and 2 hours and 10 minutes.

Three patients were in poor condition when they were first seen, because of prolonged vaginal bleeding, but they were transfused before operation and were regarded as presenting good risks. Another patient, 58 years of age, was hypertensive and had cardiac disease, but she was well compensated and a medical consultant considered operation safe. This patient had an enlarged liver, and hepatomegaly was also observed in another patient, a 36-year-old white woman. Two patients were rather poorly nourished and three were obese.

One patient died on the table at the conclusion of the operation, and one death occurred on the sixth day. The remaining deaths occurred between 8 and 72 hours after operation. In every instance death was unexpected and in several instances it was almost catastrophic.

With a single exception, to be discussed later, in which active hemorrhage was found, the outstanding postmortem findings in all of these cases were hepatic or hepatorenal changes, ranging from cloudy swelling to frank necrosis. Fatty metamorphosis was present in a number of instances, and in three was grossly evident.

In addition to the hepatic and hepatorenal changes mentioned, minor, nonlethal pathologic changes were observed in several cases. One patient had 200 c.c. of bloody fluid in the peritoneal cavity, one had a small localized area of pelvic peritonitis, and two had microscopic areas of atelectasis.

Comment

The concept of possible hepatic or hepatorenal failure after surgery is still doubted by some surgeons, chiefly, as certain writers rather bitterly point out, by those who have never experienced the disaster. On the surface, however, there seems no more reason why deaths should not occur from this cause than from cardiac failure or renal failure per se.

Clinically this type of death takes two forms. In the first, or so-called "liver death," the patient is as likely as not to be a good or fairly good risk, but he reacts slowly and sluggishly from anesthesia, his appearance and behavior are lethargic, the temperature begins to rise alarmingly shortly after operation, and death occurs within 8 to 72 hours, with extreme hyperpyrexia and a rising pulse rate dominating the clinical picture. In the second type, the so-called "liver-kidney" death or hepatorenal syndrome, the postoperative course is fairly normal for four or five days, or even longer. Then, in spite of an increased fluid intake, oliguria progresses to anuria and death clinically seems to be due to uremia. The hyperpyrexia noted in liver deaths is absent. If blood chemical tests are made, the nonprotein nitrogen and urea nitrogen, which were normal if tested before operation, are found to have risen to high levels.

Postmortem examination reveals little to explain why death has occurred. In liver deaths there are various degrees of degeneration in the liver cells. In liver-kidney deaths the same changes in the liver are present and there are also degenerative changes, sometimes progressing to necrosis, in the convoluted tubules of the kidney.

In essence, the most reasonable theory[2, 7] advanced to explain liver and liver-kidney deaths is as follows: Since any form of anesthesia has some effect on the liver, a certain fall in hepatic function can be expected after operation, even in young and healthy subjects submitted to simple surgery. The damage is accentuated by prolongation of the procedure and anesthesia, the trauma of surgery, blood loss, and the toxic effects of death of tissue. Furthermore, as demonstrated by Crile,[8] the mere opening of the abdomen causes a reduction in the temperature of the liver, a 10 per cent decrease in chemical activity resulting for every 1 degree fall in temperature.

The sum of these various factors is of little consequence in persons with intact livers, and is, indeed, survived by the majority of persons whose livers are damaged, particularly if they have been well prepared for operation. The liver is a highly adaptable organ, with multiple functions, and experimental

evidence[9] shows that it can continue to function when it has been damaged as much as 80 per cent. A damaged liver, however, which is already the site of functional and structural alteration, may be so gravely affected by the considerations listed as to undergo further damage. Eventually it may become unable to cope with its normal physiologic function of detoxifying the toxic substances which reach it in the course of normal body metabolism. As the hepatic cells become increasingly unable to fulfill their normal function, they themselves undergo necrotic changes and the circulation is presumably filled with the undetoxified substances which the liver has been unable to handle, as well as with the toxins of the necrosing hepatic cells. At this point the toxemia may be so overwhelming that the so-called liver death occurs.

If, however, the patient survives the toxemia, the failing function of the liver is taken over by the kidney, the next great detoxifying organ of the body, as a purely physiologic routine. But the kidney is not physiologically fitted for the whole task of detoxifying the normal products of body metabolism, quite apart from the toxic substances elaborated in the liver. It breaks down in its turn, and the overwhelming toxemia kills the patient in the second, or hepatorenal, phase of the syndrome.

The theory outlined has been advanced by Helwig and Schutz[7] and by Boyce.[2] The only point of difference between these observers is that the former believe that some potent toxin elaborated in the necrotic hepatic tissue has a specific effect upon the renal parenchyma, while Boyce does not believe it necessary to postulate a specific action.

Death in cases in which the liver is known to be seriously damaged is not difficult to comprehend. Much more difficult to accept is what Robertson and his associates[10] described as a "certain unexplained surgical mortality," which is attributed by a number of observers to what has been termed a "state of hepatic inferiority." Hepatic inferiority was, I believe, the background of 7 of the 10 gynecologic deaths which have just been analyzed. Some individuals, as Henschen[11] pointed out, are born "liver weaklings." Others acquire hepatic inferiority in the course of living, just as cardiac or renal inferiority develops. The numerous writers who advance this concept base their evidence partly upon the finding of unexpected pathologic changes when biopsy of the liver is performed for any reason, and partly upon the unexpected hepatic dysfunction revealed by functional tests. Boyce[2] and Rozendaal and his associates,[12] among others, have emphasized the entirely unexpected hepatic dysfunction sometimes found even in young persons, and the latter group of authors observed pessimistically that the only reason the percentage of dysfunction in their series was as low as 29 per cent was because so many of the patients had not yet had time to develop dysfunction. If their observations are accepted as valid, it is not unreasonable to assume that these patients present poor prospects for surgery, in the process of which their already deficient hepatic function may be depressed to nonviable levels, particularly because they are usually regarded as presenting good risks and are seldom prepared in any way for operation.

An experimental observation recorded by Boyce,[2] who, incidentally was able to reproduce the liver-kidney phase of this syndrome experimentally, is worth citing as illustrative of the theory just outlined.

At laparotomy on a large, vicious dog several small ecchymotic areas between the gall bladder and hepatic parenchyma were observed and were found to have been caused by a blow used to control the animal while it was being prepared for operation. Cholecystectomy and common duct ligation were rapidly performed under ether anesthesia. The dog was on its feet and moving about within fifteen minutes, but died at the end of twelve hours. Postmortem examination revealed the liver to be pale, swollen, and finely mottled, and histologic examination showed many areas of hyperemia and necrosis. The kidneys were grossly normal but histologic examination showed areas of cloudy swelling of the tubal epithelium. There was no other cause of death.

Boyce derived two lessons from this experience: The first was the rapidity with which apparently insignificant hepatic damage can be translated to a lethal degree under an additional strain, just as individuals with minimal hepatic damage are perhaps put in jeopardy when they are submitted to surgery. The second lesson was the ease with which fatal potentialities can be overlooked. He and his associates had been studying hepatic damage for at least five years, yet the lethal possibilities in this instance escaped them completely until the animal's totally unexpected death twelve hours after operation.

Those lessons seem definitely applicable to the ten cases in this small series. None of the patients had any tests of hepatic function prior to operation and, except for the patients transfused to replace actual blood loss, none of them had any preoperative preparation. The hepatomegaly present in two instances was entirely ignored. The possibility of liver failure was not suspected in a single instance after operation, though in several instances the clinical diagnoses seem to have been made in desperation, so entirely were they at variance with the clinical findings.

One patient, for instance, whose temperature rose to 103° F. the day of operation and to 104.2° the following day, escaped bronchoscopy only because she refused to submit to it. Death occurred forty-four hours after operation, and the clinical diagnosis was peritonitis, of which there had been no clinical evidence, versus atelectasis, of which there had also been no clinical evidence. At necropsy the peritoneal cavity was clean, and the atelectasis present was demonstrable only in a limited area and by microscopic examination. The liver weighed 970 grams, and both grossly and microscopically showed fatty changes, the normal lobular arrangement being completely obliterated. The convoluted tubules of the kidneys were swollen and showed slight granular changes; the glomeruli were intact.

In another case the clinical cause of death was set down as embolism versus atelectasis, but autopsy revealed neither condition. A few cubic centimeters of serosanguineous fluid in the peritoneal cavity was specifically stated not to be a true exudate, and there were no other positive findings except in the liver and the kidneys. The liver was grossly lighter than normal and slightly mottled, and microscopically showed marked parenchymatous degeneration. The kidneys were grossly normal and microscopically showed mild parenchymatous degeneration of the convoluted tubules.

In two cases death was attributed clinically to the anesthetic agent. In one case, in which death occurred at the conclusion of an operation lasting forty-five minutes and performed under ether anesthesia, the liver weighed 900 grams and was extremely soft. Microscopic examination showed marked granular changes in the cytoplasm of the polygonal cells. It does not seem unreasonable to assume that this patient, judging from the size and consistency of the liver, had a high degree of hepatic damage before operation, which was aggravated to the lethal degree by the anesthesia.

The second death attributed to the anesthetic agent occurred seven hours after operation, as the result of "sensitivity to novocaine." Analgesia was not satisfactory and was

supplemented by nitrous oxide. The operation lasted ninety-five minutes. The patient stopped breathing in the course of the procedure and was given artificial respiration for twenty minutes. Her blood pressure fell from 200/100 to 100/70 and remained low. She had bled from the vagina for a long period before admission to the hospital, and even after transfusion her red blood cells numbered only 3,500,000 per cubic millimeter. A moderate degree of edema of the brain and spinal cord was found at necropsy, and undoubtedly played a part in the fatality, but the hepatic findings were much more striking. The liver, which weighed 1080 grams, was so soft that it flattened out immediately when it was placed on the dissecting board. It was pale yellow, the natural markings were obliterated, and microscopic examination showed marked parenchymatous degeneration. The kidneys were normal. In this case the chain of events seems to include some degree of hepatic damage before operation, aggravated at operation by inadequate oxygenation, both because of the fall in blood pressure and because of the respiratory difficulties. The studies of Shaw, Steele, and Lamb[13] on anoxemia in spinal analgesia support this point of view.

One patient, as already noted, unquestionably died of postoperative hemorrhage, which was the major cause of death. The liver, however, was found at necropsy to be light grayish-brown and very soft, and normal markings were absent. Microscopic examination showed many small areas of necrosis, swollen hepatic cells, and obliteration of the sinusoids. The patient died twelve hours after operation, and it seems unlikely that such extreme hepatic changes could have occurred in so short a time. On the other hand, it seems quite reasonable that they could have been caused by preoperative damage, aggravated by the falling blood pressure at operation (94/70), and the subsequent hemorrhage, with resultant anoxemia.

The three obese patients in this series should be specially mentioned, for obesity, as Ravdin and his associates[14] have pointed out, tends to be associated with increasing concentrations of hepatic lipid. The patients in their series who were of average weight were found to have 3.9 per cent of hepatic fatty acids. Those with 1 plus obesity had 4.6 per cent, those with 2 plus obesity 6.4 per cent, and those with 3 plus obesity 10.3 per cent.

The age of the patients in the series also should be emphasized. With a single exception, the range was 36 to 58 years, and the high level bears out Boyce's[2] theory that patients with damaged livers are affected adversely by the mere act of living. He attributed the high percentage of liver damage which he observed in nodular goiters in Negroes to the fact that this type of goiter occurs in older patients, and that life, as a rule, goes harder with Negroes than with white patients.

Therapeutic Measures

Whether or not the liver played a major role in the ten fatalities in this series, postmortem observations show that it played an important role, and it is significant, as already pointed out, that neither before nor after operation was the possibility of hepatic failure suspected. The lesson is obvious. This possibility should be considered as an explanation of unexpected and inexplicable postoperative complications, and, more important, should be guarded against by adequate tests and adequate preparation before operation.

The situation is by no means as gloomy as the observations of Rozendaal and his associates[12] would indicate. For one thing, the capacity of the liver to endure insult is enormous, and the number of patients likely to die of liver failure after operation is small, even in the absence of adequate preparation. For another, though tests of hepatic function are still far from satisfactory, they are surprisingly useful in indicating those who need special preparation. Graham's[15] record in this respect is notable. On the basis that abnormal (50 per cent or more) dye retention indicates hepatic damage, he was able, by proper

preoperative preparation, to reduce his mortality for cholecystectomy over a three-year period from 6 per cent to 0.5 per cent, and his mortality for common duct surgery from 7.7 per cent to 2 per cent. Althausen and his associates,[16] by routine use of hepatic function tests, were able to reduce the mortality of biliary tract surgery at the University of California Hospital from 10 per cent to 2 per cent. Hepatic damage is, of course, much more frequent and usually much more extensive in disease of the biliary tract than in gynecologic disease.

In occasional cases hepatic damage is irreparable, and in other cases it is difficult to repair. In most cases, however, correction is reasonably simple. The administration of dextrose, preferably by the oral route whenever it is possible, a diet high in protein, the maintenance of a satisfactory fluid balance, and the use of plasma and whole blood as indicated are all that is necessary. Most patients, as a matter of fact, do not need such a regimen. A properly balanced diet, liberal fluids and additional dextrose in the form of sweetened drinks, hard candies, and jelly[12] are all that is necessary. Elaborate methods of preparation are seldom omitted when they are indicated, and it seems ironical that simpler measures, which are adequate in many cases and a wise precaution before any type of surgery, are usually omitted.

Ravdin and his associates[14] have recently established the value of a special preoperative diet, containing adequate calories and consisting of at least 74 per cent of carbohydrate, not over 6 per cent of fat, and at least 20 per cent of protein. Patients with severely damaged livers who were not prepared by this diet showed an average lipid hepatic content of 14.8 per cent, whereas those prepared with it showed a lipid content of only 4.2 per cent. The glycogen content of the liver in the prepared group was 3.3 per cent, as compared with a content of 2.8 per cent in an unprepared control group with microscopically normal livers. These observers believe that such dietary preparation is so important for patients with damaged livers that if the palatably prepared diet is not taken by mouth, it is administered by stomach tube.

All of the patients who survived operation in the small series of gynecologic deaths reported in this paper had adequate postoperative therapy, including infusions, transfusions, and inhalations of oxygen. As a matter of fact, the postoperative treatment of gynecologic patients at the New Orleans Charity Hospital is almost uniformly good. Yet, as Miller[6] pointed out, the mortality of surgery for fibroid tumors has been reduced to so low a level that there is a tendency to view all cases with complacency and to operate without proper preoperative preparation. Complacency seems the basic reason why most of these deaths in this series occurred, and a study of the cases suggests that uneasiness in respect to the liver might be a wholesome improvement in the preoperative study of the patients to be submitted to gynecologic surgery. Even if funcional tests of the liver are not practical routinely, because of the volume of clinical material to be handled, preparation with diet, a liberal intake of carbohydrates and protein, and attention to the fluid balance could be carried out for 48 to 72 hours in ambulatory patients before hospitalization and would not tax hospital facilities. The number of liver and liver-kidney deaths is small, but could be further reduced by this means. The aim of this communication is to call attention to the possibility of such a reduction.

Summary

The possibility of the occurrence of the so-called "liver" and "liver-kidney" deaths after gynecologic surgery is discussed. The theory of "hepatic inferiority" and the "liver weakling" is also discussed. Ten deaths after gynecologic surgery are analyzed, and it is pointed out that in them a liver factor was an important cause of the fatality, and sometimes the only cause. A method of preventing such deaths is briefly outlined.

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AN EVALUATION OF THE GUTERMAN PREGNANCY TEST

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THE role of progesterone in the physiology of menstruation and reproduction has been well established.[1, 2] The isolation of pregnanediol,[3] the end product of progesterone metabolism, and the development of biochemical assay for this compound[4] has made it possible to obtain a quantitative measure of the functional activity of the corpus luteum. Pregnanediol, in the form of its acid-hydrolyzable complex, sodium pregnanediol glucuronidate, is found in the urine of nonpregnant women during the luteal or postovulatory phase of the menstrual cycle. If impregnation occurs, the compound is found continually in increasing amounts until parturition. Quantitative studies of the excretion of pregnanediol in the urine of pregnant and nonpregnant women have been reported by a number of workers.[5-10]

The increased excretion of sodium pregnanediol glucuronidate in the urine of pregnant women has been used for the early diagnosis of pregnancy by a number of investigators.[5, 6, 11, 12] Most of these methods depend upon gravimetric determination of pregnanediol by the methods of Venning[4] or of Astwood and Jones.[13*] Talbot and co-workers[14] have developed a colorimetric assay method based upon the color complex developed by free pregnanediol when dissolved in concentrated sulfuric acid, as originally described by Kober.[15] This reaction was shown by Zimmermann[16] to occur also with certain 17-ketosteroids. Guterman[17] has recently attempted to combine the methods in effecting a rapid and accurate pregnancy test.

The Guterman test depends upon the isolation of pregnanediol by a modification of the procedure devised by Astwood and Jones, followed by the addition of concentrated sulfuric acid to the dried compound. A colorless to yellow solution is read as negative, and an orange to brown solution is considered to be indicative of pregnancy. A positive color reaction results, according to Guterman, when 1 mg. or more of free pregnanediol is present in 100 ml. of morning urine. It is his contention that the presence of a positive color reaction in the presence of amenorrhea indicates a normal pregnancy.

It has been demonstrated that the excretion of sodium pregnanediol glucuronidate during the luteal phases of normal nonpregnant women varies from day to day and from patient to patient.[5, 6] This is apparently dependent upon the functional activity of the corpus luteum of the particular cycle observed and the efficiency of the metabolic and excretory mechanisms.[6]

*In the Guterman modification of Astwood and Jones' procedure, one precipitation is omitted. This step, which also involves washing with petroleum ether, removes any 17-ketosteroids which have been coprecipitated with the pregnanediol.

The purpose of the present experiment is to evaluate the Guterman test. The cases studied included normal nonpregnant women, early pregnancies, conditions simulating or likely to be confused with pregnancy, and normal males.

Method

First morning specimens are used in all cases. These are collected over 1 to 2 Gm. of sulfanilamide as a preservative, and specimens are kept refrigerated until used. At no time is this period longer than seventy-two hours.

The technique employed is that described by Guterman with slight modifications for convenience in this laboratory and with the addition of a colorimetric procedure.

In all cases where an electric hot plate is specified by Guterman, vacuum distillation over a steam bath is substituted, with the exception of the original hydrolysis where a Bunsen flame is employed.

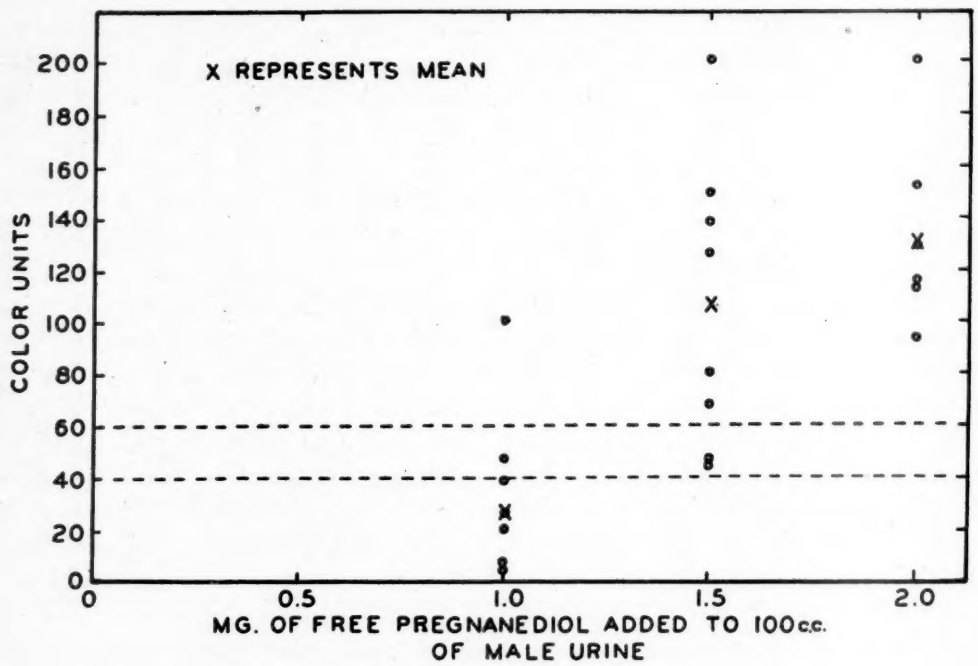

Fig. 1.

In step *B-3*, 1 ml. of a 20 per cent solution of sodium in 95 per cent ethanol is used in place of 20 ml. of 10 per cent sodium hydroxide.

In step *B-5*, filtration by gravity through No. 42 Whatman paper is used instead of a fritted glass filter.

In step *D-1*, filtration through No. 42 Whatman paper in a 3 cm. Büchner funnel is used instead of a fritted glass filter.

Colorimetric Procedure.—This step is added because of the difficulty encountered in measuring the color shades by direct observation, particularly in borderline cases.

A color standard is prepared which exactly matches in the Klett photoelectric colorimeter the color obtained when male urines are subjected to the procedure. This is a potassium dichromate solution of 3.42 Gm./1 concentration. A filter having a transmission range of 500 to 570 millimicrons is used. With standard in place, the galvanometer is balanced with the dial at zero by adjusting the diaphragm. The standard is then replaced by the sample in a colorimeter tube, and the galvanometer balanced with the resistance dial. The dial reading is recorded directly, and results are expressed in terms of the dial reading or "color units" (C.U.).

The color units are standardized, as shown by the graph (Fig. 1) from the readings given by prepared samples of male urine to which known amounts of sodium pregnanediol glucuronidate are added. We consider 40 to 60 C.U. as the range of transition between positive and negative; all values above this band are orange to brown, and those below are yellow. Quantitatively, this zone represents 1.0 to 1.5 mg. of free pregnanediol per 100 ml. of urine. This is the same transition point used by Guterman in judging his samples by direct vision.

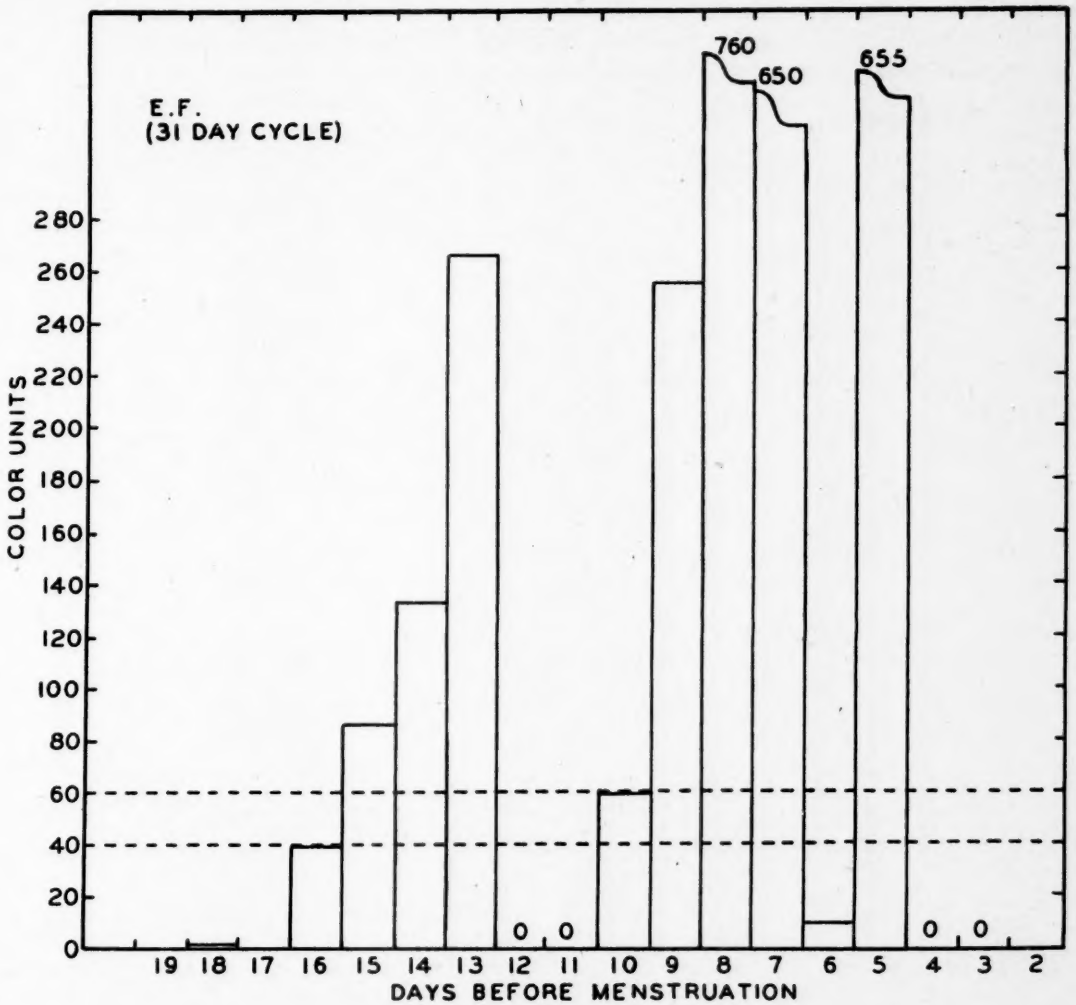

Fig. 2A.

As seen in the graph, there is considerable variation in the color resulting from the addition of identical amounts of sodium pregnanediol glucuronidate. This occurs in spite of quantitative methods, and the variable recovery is unexplained.

Results

1. *Nonpregnant Women.*—Urine specimens were collected from five apparently normal women during the latter half of the menstrual cycle. Follow-up studies confirmed that none was pregnant. Collections were begun ten to seventeen days before the expected date of bleeding. In one case, only three specimens were collected, but in four women complete collections during the luteal phase were obtained. The results of the determinations are shown in Fig. 2.

It is seen that in the cases graphed there are 18 values recorded which fall within the range regarded as positive. In the fifth case, which is not graphed, the values for the three specimens collected eleven, nine, and seven days before bleeding were 34, 24, and 310 C.U., respectively. The last was a strongly positive test.

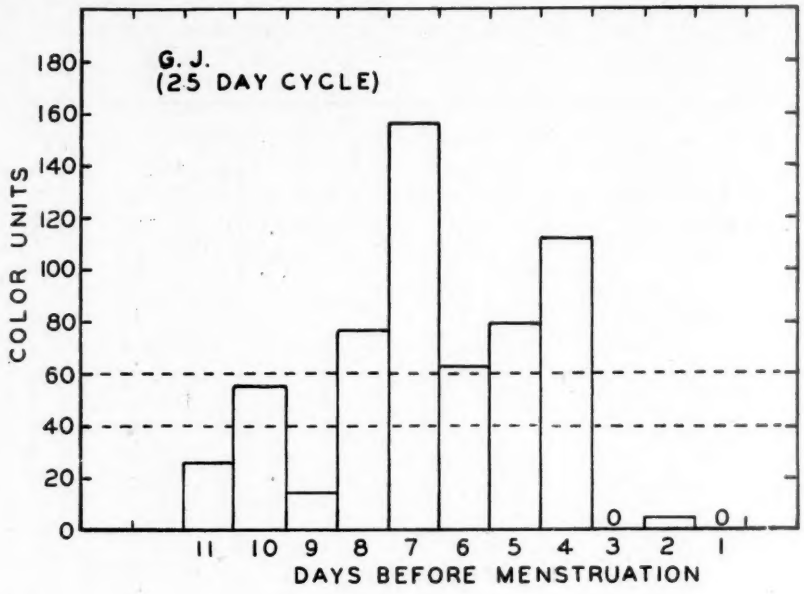

Fig. 2B.

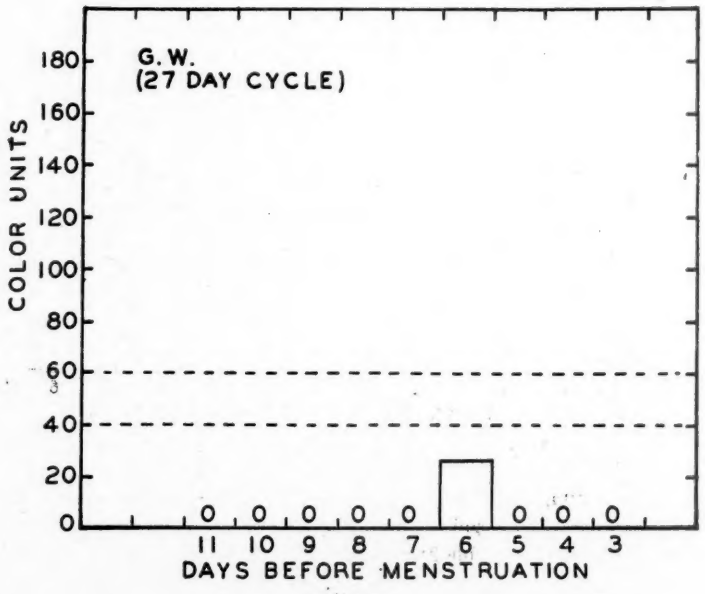

Fig. 2C.

2. *Early Pregnancies.*—

CASE 1.—M. J. complained of abdominal pain. A history was obtained of amenorrhea for six weeks, followed by vaginal spotting. The abdomen was diffusely tender and a mass was palpable in the right adnexal region. The impression, confirmed by subsequent follow-

up, was a six to seven weeks' intrauterine pregnancy and hydrosalpinx. The color test gave a positive reading of 520 color units.

CASE 2.—C. D. was being followed because of previous abortions. The test was run at the seventy-fourth day of the pregnancy and gave a negative reading of 22 color units. The gravimetric pregnanediol determination at this time was 3.2 mg./24 hours. This pregnancy has been followed to six months and is progressing normally.

CASE 3.—E. G. also was being followed because of previous abortions. A test was run at eight weeks of gestation, and the reading was positive at 163 color units. The pregnancy has been followed to six months and is apparently normal.

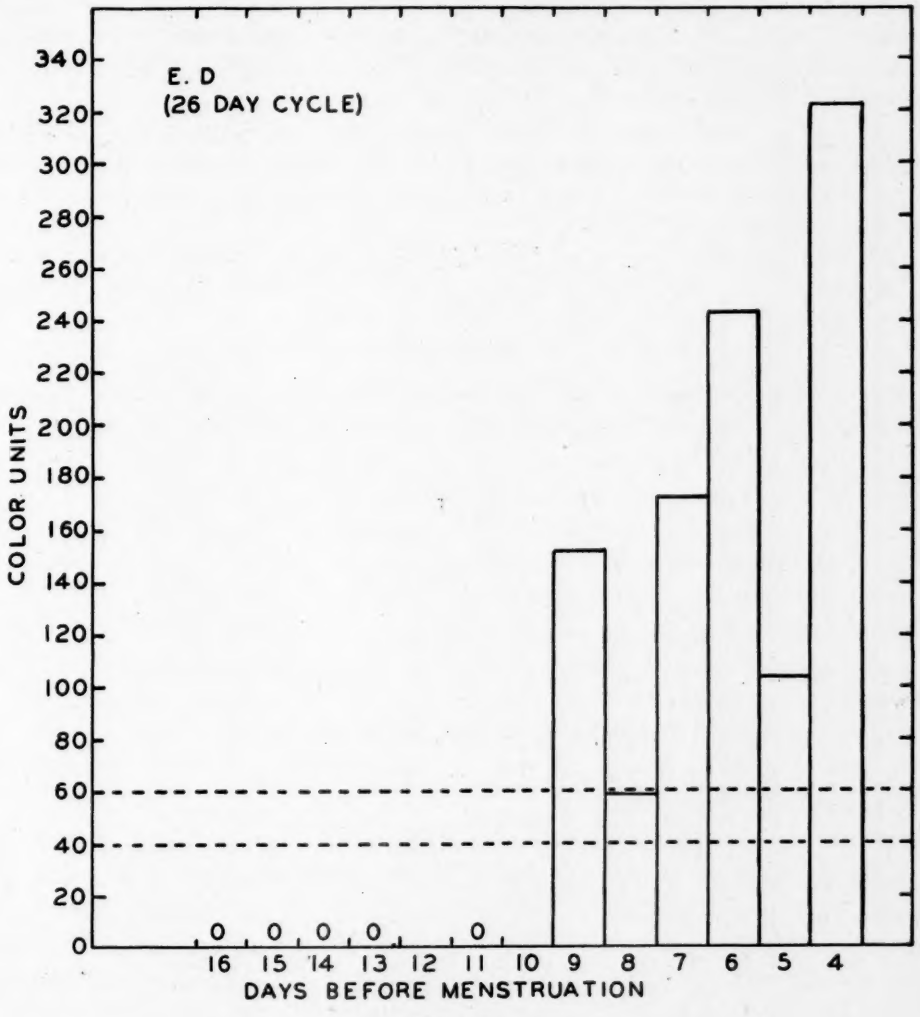

Fig. 2D.

3. *Conditions Simulating Pregnancy.*—

CASE 4.—R. B. was admitted complaining of amenorrhea of six months' duration, previous menstrual irregularities, and a questionable increase in the amount of hair on her arms and legs. A pelvic examination revealed a mass in the right adnexal region 5 to 6 cm. in diameter. At laparotomy a right ovarian tumor was removed, which proved to be an arrhenoblastoma. The color test before operation was 540 C.U., and after operation showed no pregnanediol. The 17-ketosteroid determination done before operation gave a value of 59 mg./24 hours; after operation this fell to 11 mg./24 hours.

CASE 5.—P. H. was registered in the obstetric dispensary with the clinical diagnosis of "an unquestionable 10-week pregnancy." She was admitted for termination of the pregnancy because of adenocarcinoma of the breast with metastases. A curettage revealed metastatic adenocarcinoma and normal interval endometrium with no evidence of pregnancy. The color test gave a positive reading of 340 color units.

CASE 6.—C. B. was admitted complaining of cramping abdominal pain and frequent vaginal bleeding of two months' duration. A laparotomy revealed a corpus luteum cyst with recent hemorrhage and pelvic inflammatory disease. The color test gave a reading of 0 color unit.

CASE 7.—M. R. was admitted on the obstetric service because of cessation of fetal movements for six weeks. The last menstrual period had been fifty-seven weeks previous. Operation revealed an abdominal pregnancy with a macerated fetus. A specimen collected at the time of operation showed 720 color units.

CASE 8.—M. C. was admitted complaining of sudden pain in the left lower quadrant, irregular bleeding, and amenorrhea for five weeks. The clinical diagnosis was ectopic pregnancy. An operation showed salpingitis with torsion and infarction of the tube. The color test gave a reading of 173 color units.

Rat pregnancy tests done on all patients in this group were consistently negative.

4. *Male Urines.*—Six specimens of male urine were examined. All showed 0 color unit.

Discussion

Forty-nine specimens from five normal nonpregnant women were tested by the Guterman method; 19 positive and 2 doubtful tests were obtained. These results show that false positive tests for pregnancy are obtained frequently during the luteal phase in nonpregnant women. The importance of this observation is that *in cycles prolonged by late ovulation the corpus luteum may be at the peak of functional activity at a time when the bleeding period is considered to have been missed.* Furthermore, the colorimetric values recorded in early pregnancy overlap those of normal cycles (see Cases 1, 2, and 3, and Fig. 2). This is confirmed by the gravimetric studies of several workers. Venning and Browne[10] report values up to 8.1 mg./24 hours, Hain and Robertson[6] 14 mg./24 hours, and Tien[18] 13.3 mg./24 hours in normal nonpregnant women, while the latter gives values as low as 6.2 mg. of pregnanediol per 24 hours in the first month of normal pregnancies.

In the three cases of early pregnancy studied, two showed positive tests in the seventh or eighth weeks. One case gave a negative test in the seventh week, but this patient was known to be an habitual aborter. Gravimetric determinations of the pregnanediol excretion in this laboratory gave a value of 3.2 mg./24 hours at the time of our test. This pregnancy, however, has been maintained for six months without hormone therapy and is apparently normal. Thus it appears that the Guterman test, usually positive in early pregnancy, may occasionally be negative in pregnancies which continue normally.

Guterman maintains that a positive test in the presence of amenorrhea indicates a normal pregnancy. There are several conditions in which this assumption is not valid. The case of arrhenoblastoma (Case 4) shows that a high level of 17-ketosteroid excretion gives a positive test.[1] These compounds give a positive color reaction according to Kober.[15] Case 5 is an excellent example of a

positive test in the presence of amenorrhea and uterine enlargement due in this instance to carcinoma metastases. Case 8 was diagnosed clinically as ectopic pregnancy and a positive Guterman test obtained. Operation showed salpingitis with torsion and infarction of the tube. The rat pregnancy test was negative in all three of these cases.

Case 6 is a case of corpus luteum cyst giving a negative test. This may have been due to the hemorrhage present.

Summary

1. The Guterman test for pregnancy was found positive in a large percentage of normal nonpregnant women during the luteal phase of the menstrual cycle.

2. In one case of an apparently normal pregnancy of seven weeks' duration, a negative Guterman test was obtained.

3. A positive Guterman test may be obtained when large amounts of 17-ketosteroids are present in the urine, as in arrhenoblastoma.

4. In the presence of amenorrhea the Guterman test may be positive on the basis of a functioning corpus luteum without pregnancy.

The authors wish to thank Dr. G. E. Seegar Jones and Dr. Eleanor Delfs for their able advice and assistance in this work, and Mr. H. M. Stran for his help in the laboratory.

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UTERUS DIDELPHYS AND ITS CLINICAL SIGNIFICANCE IN PREGNANCY

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THE degree of duplicity of the uterus, cervix, and vagina depends entirely upon the degree of failure of fusion of the Müllerian ducts. When there is a complete lack of fusion, double uterus, double cervix, and double vagina result. This type of abnormality is called "complete uterus didelphys." The degree of lack of fusion of the Müllerian ducts determines the type of abnormality that will result, and any number of different types of partial or complete duplication of the uterus, cervix, and vagina is possible. The lack of fusion may be complete so far as the uterus is concerned, while the cervix and vagina may be completely fused. No type of duplication of these organs except the one resulting from complete lack of fusion of the Müllerian ducts will be discussed in this paper. Although this complete lack of fusion is the rarest of the pelvic malformations, it is probably true that the incidence of congenital anomalies in the female genitalia is higher than statistics would indicate. Many women probably go through life without knowledge of the defect. The literature on this abnormality is extensive but most authors have included in their reports all types of pelvic and uterine abnormalities. For this reason only one type of malformation will be discussed in this report.

There are four times during a woman's life when this abnormality is most likely to be found. First, during adolescence, especially if the patient complains of some menstrual disturbance or dysmenorrhea; second, at the time of premarital examination; third, after marriage, should the patient complain of dyspareunia or unexplained abortion; and fourth, during pregnancy. In this paper we are concerned primarily with the latter group because uterus didelphys is usually of no clinical significance except in pregnancy. The abnormality may, however, be complicated by any type of pelvic disease, in which case the patient's complaints will usually be referable to the disease and not to the pelvic anomaly.

The history in these cases is usually of little value. The individual may complain of some menstrual disturbance, delay in onset of the flow, intermenstrual bleeding, dysmenorrhea, dyspareunia, or even amenorrhea. All of the cases reported gave a history of one or more of these symptoms.

The primary diagnosis may in some cases be difficult. The presence of a mass in the pelvis may be difficult to differentiate from a pedunculated fibroid or an ovarian cyst. Hysterosalpingography may be of value. Whenever a vaginal septum is found, whether it be partial or complete, a careful search should be made for a double cervix and double uterus either partial or complete.

The clinical significance of uterus didelphys during pregnancy is important. Many unusual cases have been reported and the methods by which they have been handled have varied considerably. Naturally it is impossible to draw any definite conclusions from a single case and yet this is the error that many authors have made. Some men have treated these cases much the same way as a normal pregnancy and have disregarded the abnormality present, while others have advised extremely radical surgery even in the presence of pregnancy. In November, 1931, Frank R. Smith gave the most complete and intelligent report thus far presented. He stated that this abnormality is found once in about every twenty-seven or twenty-eight thousand women and once in every fifteen hundred pregnancies. Sterility is much more common among these women, but once pregnancy occurs the cases are about even.

Complications During Pregnancy.—Abortion and premature labor seem to be quite common. This tendency, according to many authors, is most common in breech and transverse presentations. Vaginal bleeding of varying amounts is a relatively common symptom and is usually due to bleeding from the nonpregnant uterus. If this blood is examined under the microscope, decidual tissue will be found. This is due to the fact that the reaction of the endometrium of the nonpregnant uterus is the same as in an ectopic pregnancy. Following delivery the decidua in the nonpregnant uterus is cast off. The nonpregnant uterus usually increases two or three times its size. Premature separation of the placenta or abruptio placentae and placenta previa, either partial or complete, have been reported. These complications were present in Cases 2 and 4.

Complications During Labor.—Labor may be prolonged because of weak or deficient musculature. Many authors list a uterus didelphys as one of the causes of uterine inertia. Rupture of the uterus may occur during labor either because of a very thin lower uterine segment or as a result of dystocia. Prolonged labor and weak uterine contractions and dystocia resulting from impaction of the nonpregnant uterus usually result in a high percentage of operative deliveries. Fetal morbidity and mortality are increased as a result of operative interference. Malpositions and abnormal presentations are more common, due to interference from the nonpregnant uterus.

No cases of ruptured uterus were observed in this series. Obstruction of the birth canal by the nonpregnant uterus was seen in Cases 1, 2, and 4. Fetal morbidity as a result of operative interference is illustrated in Case 6. Malposition was seen in Case 4 (two pregnancies).

Postpartum Complications.—Postpartum hemorrhage and subinvolution are listed as common postpartum complications probably due to poor contraction of the uterine musculature. Retained placenta probably results from malposition of the placenta and interference with normal uterine contractions by the nonpregnant uterus or from weak or deficient uterine contractions of the pregnant uterus. None of these complications occurred in any of the cases reported in this paper.

No fixed rule or type of operation can be applied in the treatment of this abnormality when pregnancy occurs. Each case is an individual problem and to apply a general rule to all such cases would be rendering the patient a grave injustice. To be sure, all of these patients should be under the care of a competent obstetrician. Prenatal care should include close observation, frequent rest in bed if necessary, abdominal support when indicated, and careful avoidance of trauma of any kind. Should premature separation of the placenta or premature labor occur, one should be prepared, if necessary, to do an abdominal section. If a test of labor is decided upon, one should be prepared to do a cesarean section if dystocia or fetal embarrassment should occur. Cesarean section will eliminate maternal exhaustion, prolonged labor, undue complications, and decrease fetal and maternal mortality and morbidity.

Unless the deformity is very slight and the nonpregnant uterus very small, dystocia is more likely to occur. The nonpregnant uterus may become incarcerated in the hollow of the sacrum or in other ways block the maternal pelvic outlet. If a suspension of both uteri has been previously done and the patient then becomes pregnant, uncomplicated labor and delivery may result. This probably is due to the fact that the nonpregnant uterus is carried up out of the pelvis, and when labor occurs it fails to cause any dystocia. Such a case was reported by Browne in 1938 and a similar case is reported in this paper (Case 3).

As mentioned above, no special treatment of these cases, outside of pregnancy, is necessary unless the patient complains of dyspareunia or the abnormality is associated with some pelvic disease or tumor. Dyspareunia is usually caused by the vaginal septum and the removal of the septum is usually sufficient in these cases.

The indications for cesarean section are weakened musculature, dystocia, abruptio placentae, premature separation of the placenta, and placenta previa. It is advisable to have all of the patient's pelvic measurements substantiated by x-ray pelvimetry. All cases of contracted pelvis and borderline contractions should be treated by cesarean section. A patient with a very large outlet probably should be permitted a test of labor, but the obstetrician should be prepared to do an abdominal section if necessary. If during the latter month of pregnancy the nonpregnant uterus can be palpated and proved to be causing any blockage of the pelvic canal, elective cesarean section should be done. In the presence of uterus didelphys, we believe it is more conservative to do an elective cesarean section than to submit the patient to unnecessary risks. A competent obstetrician should, however, know when to operate and when not to operate.

CASE 1.—P. L., aged 22 years, was first seen July 12, 1944. Last menstrual period, Jan. 25, 1944. Calculated date of confinement, Nov. 2, 1944.

Catamenia: Began at the age of 13 years, never regular. Usually menstruates every three to six weeks. Has occasionally had periods of amenorrhea lasting from two to six months. Menses usually last about five days, with dysmenorrhea severe.

Operations: Vaginal septum removed Feb. 28, 1943, because of dyspareunia. The condition of uterus didelphys was not discovered until the time of this examination.

Blood count: Normal.

Weight: Normally 98 to 103 pounds.

Serology: Negative.

Pelvimetry: Within normal limits.

Pelvic examination: Two cervices. The uterus on the right side is more fully developed. The pregnancy is in the right uterus with a smaller mass felt in the left lower quadrant.

On Nov. 20, 1944, examination revealed the presenting part (head) was not engaged. An obstructing mass (left uterus) could be felt in the pelvis.

Treatment: The patient was delivered by classical cesarean section. The pregnancy was in the right uterus and the obstructing mass was the nonpregnant left uterus. The peritoneal reflection of the urinary bladder was attached anteriorly to both uteri and then dipped down between the two uteri to become attached to the peritoneum in the pouch of Douglas. Each uterus had one tube and one ovary. The mother had an uncomplicated convalescence and the baby is living and well.

CASE 2.—M. G., aged 24 years, was first seen Sept. 11, 1944. Last menstrual period, June 27, 1944. Spotting occurred July 23, 24, 26, 27, and 28, 1944. Calculated date of confinement, April 3, 1945. Although the patient had been married for three years, the condition of uterus didelphys was not discovered until the time of this examination. No history of dyspareunia.

Catamenia: Began at the age of 12 years. Twenty-eight day type, lasting three to four days. No menstrual irregularities.

Operations: Appendectomy and operation for intussusception at the age of eight months.

Blood count: normal. Prothrombin: 106 per cent of normal. Rh factor: positive. Serology: negative. Pelvimetry: within normal limits.

Examination revealed a double uterus, double cervix, and double vagina. The left uterus was considerably larger than the right. The left vagina was considerably larger than the right.

Oct. 4, 1944, the patient was admitted to the hospital because of slight vaginal bleeding. It was definitely determined that the bleeding was coming from the right nonpregnant uterus. Microscopic examination of this blood revealed the presence of decidual tissue. Bed rest was continued until October 18 when the patient was permitted to leave the hospital. Her activities at home were considerably restricted. There was very slight vaginal bleeding on October 31.

Feb. 10, 1945, the patient had slight vaginal bleeding definitely coming from the right uterus.

March 10, 1945, the patient was admitted to the hospital with severe painless vaginal bleeding. The abdomen was soft and there was no pain on palpation. The uterus was not contracted. The bleeding was from the left uterus. Rectal examination revealed dilatation of the left cervix amounting to about 3 cm. An obstructing mass could be felt in the right pelvis. It was felt that the patient had a placenta previa and she was immediately prepared for a cesarean section.

The patient was delivered by classical cesarean section. The pregnancy was in the left uterus. The placenta was of the marginal type and was attached anteriorly. The peritoneal reflection of the urinary bladder was attached anteriorly to both uteri and then dipped down between the two uteri to become attached to the peritoneum in the pouch of Douglas. Each uterus had one ovary and one tube.

The patient made an uncomplicated postoperative convalescence. The baby was normal and required no special treatment.

CASE 3.—G. D., aged 21 years, was first seen on June 1, 1942, with a chief complaint of pain in the right lower quadrant.

Catamenia: Began at the age of 12 years. Twenty-eight- to thirty-day type, lasting five to six days. Occasional spotting between periods.

Abdominal examination revealed local tenderness over McBurney's point. Vaginal examination revealed a double vagina, the one on the left being somewhat larger than the right. There were two separate cervices, the one on the left being somewhat larger. Two separate masses were palpable in the cul-de-sac and these were thought to be two separate uteri. The patient had no previous knowledge of this condition.

On June 11, 1942, a laparotomy was done for appendicitis. Examination of the pelvic contents revealed the uterus on the left side to be somewhat larger than the one on the right. Each uterus had one tube and one ovary. The urinary bladder was attached anteriorly to both uteri and then dipped down between the two uteri and was attached to the peritoneum in the pouch of Douglas. Both uteri were markedly retroverted. The uteri were lifted out of the cul-de-sac and the round ligaments were shortened by a modified Gilliam technique, using black silk. The patient made an uneventful postoperative convalescence. The patient was advised to obtain competent obstetric consultation should she become pregnant.

The patient became pregnant in November, 1943. She had moved from Michigan and was delivered in another state, Aug. 7, 1944. A letter from the attending obstetrician stated that the pregnancy was in the left uterus, and the patient had a perfectly normal prenatal period. She had no pain or discomfort and there was no bleeding. Her labor was progressive and without complications of any kind. There were no postpartum complications. The infant was normal and is living and well.

CASE 4.—S. H., aged 19 years, was first seen May 16, 1940, with a chief complaint of miscarriage. Last menstrual period was Jan. 10, 1940. On April 22, 1940, the patient began to bleed vaginally and on April 26 apparently passed the fetus and membranes intact. She stated that she flowed heavily for three days and then had slight bleeding for an additional two weeks.

Catamenia: Began at the age of 12 years. Twenty-eight- to thirty-two-day type, lasting four days. Occasional spotting between periods.

Examination showed a double vagina, the one on the left side being the larger of the two. There were two cervices and two separate uteri. The pregnancy was apparently on the left side because a small laceration of this cervix could be demonstrated. The patient was again seen July 8, 1940. Her last menstrual period was May 22 to 28, 1940. No history of dyspareunia. Examination at this time revealed the pregnancy to be in the left uterus. Pelvic measurements revealed a justo minor pelvis with some flattening. The patient was seen on September 7 complaining of vaginal bleeding and this continued until September 17. This bleeding was definitely from the right uterus. A urine pregnancy test at this time was positive. X-ray of the abdomen taken Jan. 23, 1941, showed a single pregnancy with the fetus in dorsolumbar transverse presentation with the fetal skull in the left flank.

On Feb. 17, 1941, a classical cesarean section was done. The pregnancy was in the left uterus, the fetus was in the position as described in the x-ray, and the right uterus was wedged in the pelvis. The placenta was attached to the posterior wall of the uterus. The mother made an uneventful postoperative convalescence. Baby is living and well.

A second cesarean section was done Jan. 13, 1943. The pregnancy at this time was in the right uterus and the fetus was in the sacrum right posterior breach presentation. The patient again made an uneventful postoperative convalescence.

As in previous cases described, each uterus had one tube and one ovary. The bladder was attached anteriorly to both uteri and then dipped down between the two uteri to become attached to the peritoneum in the pouch of Douglas. The mother made a normal convalescence. Baby is living and well.

During the past six months, the patient has complained of dyspareunia. The vaginal septum is to be removed in the near future.

CASE 5.—M. L., aged 26 years, was first seen, March 24, 1945, with chief complaint of a missed menstrual period. Last menstrual period, Feb. 15 to 21, 1945. The patient gave a history of exposure and no history of dyspareunia.

Catamenia: Began at the age of 12 years. Thirty-day type, six to seven days' duration. Occasionally misses a month.

Examination revealed double vagina and double cervix. Both cervices were small, although the cervix on the left side was somewhat larger. Two uteri were palpable. The one on the left was somewhat larger.

A urine pregnancy test was done and this was negative. The patient began to menstruate April 26 and the period was of six days' duration.

Because the patient had no complaints, she was advised to do nothing about the pelvic abnormality. She was advised to obtain competent obstetric care should she become pregnant.

CASE 6.—E. H., aged 30 years, came in for pelvic examination on April 30, 1938. The following history was obtained from both the patient and the hospital at which she had been operated upon.

She was admitted to the hospital June 28, 1928, with a chief complaint of dyspareunia. A vaginal septum and two cervices were found and a hysterosalpingography revealed a double uterus. On July 5, 1928, the following operation was done: section of the vaginal septum, inflation of the tubes from within outward, and an appendectomy. The septum was comparatively thick and examination of the pelvic structures revealed complete uterus didelphys, each uterus having one tube and one ovary. The uteri were about equal in size although slightly smaller than normal. There was no retroposition. On April 30, 1930, the patient was delivered vaginally. The delivery was terminated with instruments and resulted in a child with spastic paralysis. The birth injury was directly attributed to the instrumental delivery. The child became a very difficult nursing problem for the family and finally succumbed at the age of 8½ years. To my knowledge there had been no subsequent pregnancies.

Examination on this date, April 30, 1938, revealed the condition as described above. The vaginal septum had been removed and there were two separate cervices of about equal size. Two separate uteri were easily palpable.

Conclusions

1. Uterus didelphys is a pelvic abnormality resulting from complete lack of fusion of the Müllerian ducts.

2. Pregnancy may occur in a woman with uterus didelphys. Some cases have been reported in which pregnancy has occurred simultaneously or at different times in both uteri.

3. No special treatment of uterus didelphys outside of pregnancy is necessary unless the patient complains of dyspareunia or unless the abnormality is associated with pelvic disease or tumor.

4. Careful supervision during the prenatal period is advised. All individuals with uterus didelphys should have careful pelvic measurements including x-ray pelvimetry.

5. During pregnancy-abortion, premature labor, abruptio placentae, and premature separation of the placenta are more common than when uterus didelphys is not present.

6. During labor-maternal exhaustion, fetal embarrassment, prolonged first stage of labor, rupture of the uterus, and dystocia may occur. Oblique and other abnormal presentations are more common.

7. Following labor-postpartum hemorrhage, retained placenta, and subinvolution may occur. None of these complications were observed in this series.

8. Operative deliveries may result in increased fetal morbidity and mortality. This was not true in this series, except in Case 6.

9. Milder forms of uterus didelphys will probably cause no trouble.

10. Elective cesarean section will in certain cases be the operation of choice. Each case must be treated individually, and whenever advisable a test of labor should be given. Uncomplicated delivery will occur in many cases.

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UTERUS DIDELPHYS

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VARYING degrees of abnormality in the female genital tract are due to nonunion of the Müllerian ducts. The terminology for double uterus is confused (DeLee lists nine variations), but Dorland's *Medical Dictionary*, twentieth edition, defines double uterus or uterus didelphys as "either of two distinct uteri occurring side by side in the same individual."

The gross abnormalities are rare. Taylor[1] found 262 cases of double uterus with pregnancy reported in the literature of recent years. Obenour[2] found only 15 cases of double uterus and vagina reported in different parts of the world since 1879. All investigators[3-8] emphasize the difficulty of diagnosis, even after one or more pregnancies. Findley[9] suggested that such cases are usually fertile, although abortions and premature deliveries are more frequent. He notes Robertson's case of a woman who had had 13 babies in five pregnancies. Ladd and Chisholm[10] report successful surgery for incontinence in a 12-year-old girl with double uterus, vagina, and rectum. Early diagnosis is important because of the dangers of subsequent pregnancy.

Case Report

F. L., a 38-year-old nullipara, entered Immanuel Hospital, May 1, 1945, complaining of severe disabling pain in the lower right abdominal quadrant during her menses, requiring opiates for relief from excruciating pain, particularly since an operation five years ago. At that time a laparotomy (in another city) revealed a double uterus in a retroflexed position and a double vagina. The vaginal septum was removed; a Baldy-Webster type of uterine suspension and appendectomy were also done. She consulted the author six months after her marriage, upon advice of her local physician, who had suggested ligation of the Fallopian tubes to prevent conception. General physical examination was essentially negative.

Pelvic examination showed a cervix of about normal size containing two openings with a small sulcus between. Close scrutiny showed slight scarring from the previous removal of the vaginal septum. Upon bimanual examination, the corpus was slightly larger than normal, in a normal position, but with a rather marked fullness and hardness on the right side. For diagnostic purposes iodized oil was injected into the right cervical os; the oil failed to enter the uterine cavity, but ran out around the cannula and into the vaginal vault. When the cannula was introduced into the left cervical opening, the iodized oil flowed freely into the endometrial cavity and out into the Fallopian tubes, as shown by the roentgenogram (Fig. 1).

A laparotomy was done May 2, 1945, under morphine-scopolamine analgesia and general ether anesthesia. The peritoneal cavity was entered after removal of the old midline scar. Numerous coils of both small and large intestine were found to be firmly adherent to the posterior surface of the uterus, extending from the fundus down into the posterior cul-de-sac. Adherent bowel was also found to obliterate the right adnexal region from view. Release of these adhesions by both blunt and sharp dissection disclosed the uterus with a cleft dividing the uterine corpus into an apparently normal left-sided and a larger right-sided portion. The entire right side of the uterine corpus seemed to be composed of a solitary fibroid tumor, which approached the size of a large orange at the widest diameter. The uterine corpus was not divided into two distinct bodies, but rather fused, as described above.

The right Fallopian tube was long and kinked in several places; a cystic ovary the size of an English walnut was found buried in a mass of adhesions in the right adnexal region and was punctured by use of a hemostat. The left tube, buried by more or less soft adhesions, and a small ovary were found near the base of the broad ligament.

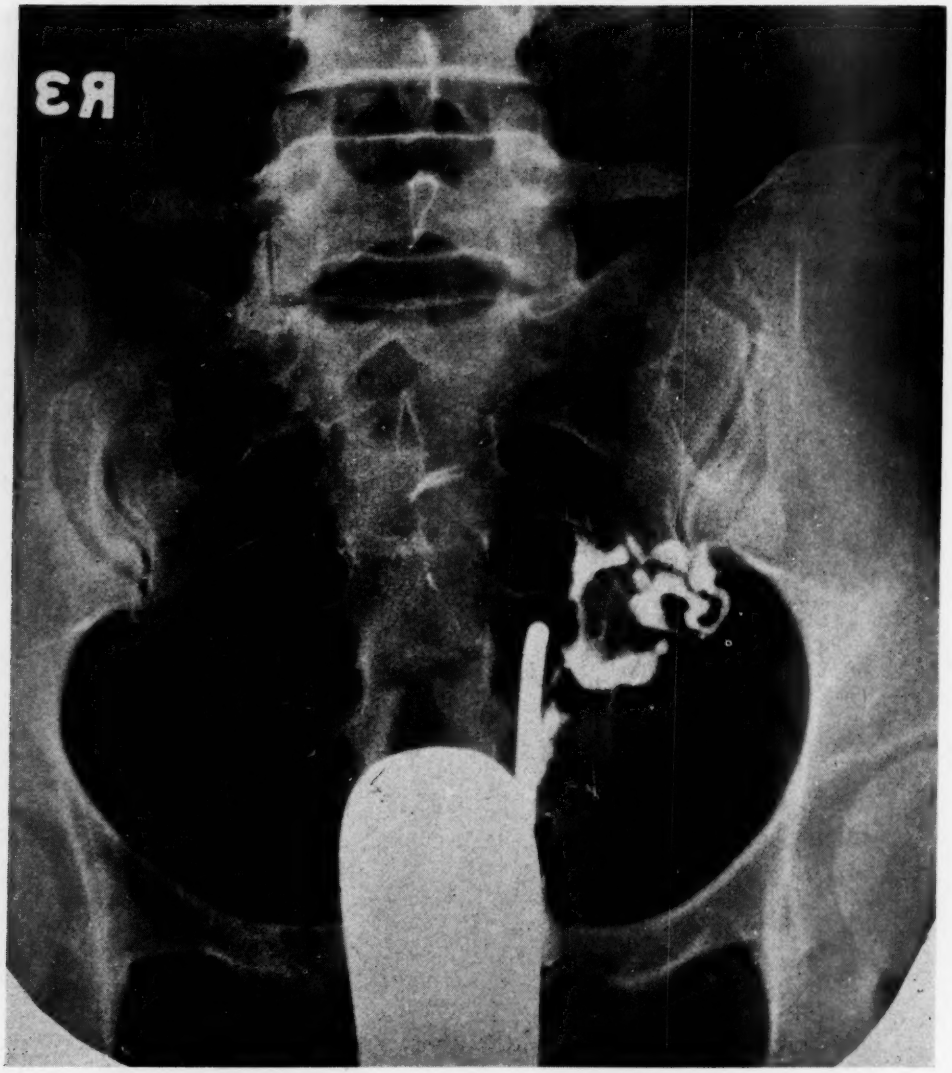

Fig. 1.—View showing iodized oil extending out into entire portion of left Fallopian tube and slight amount into peritoneal cavity.

A subtotal hysterectomy was done with some difficulty because of a severe, clockwise torsion of the uterus; it was feared that total hysterectomy would damage the ureter, which was obliterated by dense adhesions of bladder to uterus. Upon opening the uterus after hysterectomy, the right endometrial cavity was found to be completely obliterated by a fibroid tumor filling the entire right side of the uterine corpus. The left side contained a very narrow endometrial cavity (Fig. 2).

Recovery was uneventful and the patient was dismissed on the tenth postoperative day.

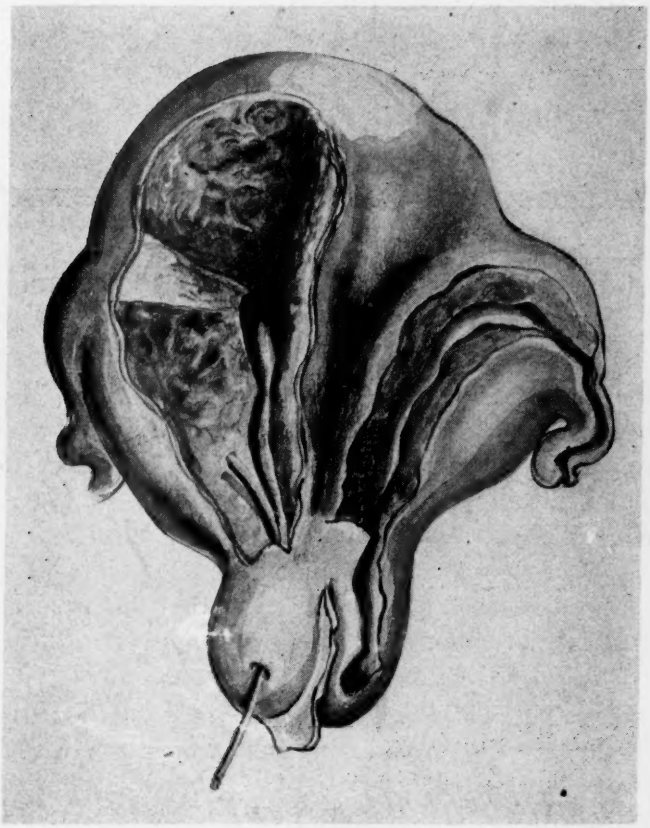

Fig. 2.—Anterior view of uterus reconstructed after specimen was removed from abdomen showing a probe in right cervical canal and showing right endometrial cavity being blocked by a large fibroid. Left portion of uterus was quite normal in appearance. Both sides of the uterus were opened by incision down to endometrial cavity previous to making above sketch.

Summary

This case report is presented to add another case of uterus didelphys to the literature. It also differs from many others in that this patient was seen late in the childbearing age, although only a few months after marriage. Her primary complaint was disabling dysmenorrhea, a condition easily conceivable in view of her pelvic pathology. This has been entirely corrected since performance of pelvic surgery.

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EVALUATION OF A NEW CONTRAST MEDIUM FOR HYSTEROSALPINGOGRAPHY*

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THE well-known shortcomings of the various contrast media that have been available for the x-ray study of the uterus and the uterine tubes have caused gynecologists generally to restrict the use of this valuable diagnostic procedure. This attitude has been shared by the Department of Gynecology of the Jefferson Medical College Hospital where, until recently, hysterosalpingography has been used only occasionally. However, the development of the medium herein described has convinced us that this procedure now can be used freely under the proper circumstances without fear of injury to the pelvic tissues.

During the past twenty-five years, a number of investigators have attempted to develop an ideal contrast medium which, as stated by Neustaedter and his associates in 1933, and restated by Rubin in 1936, should possess the following prerequisites: (1) adequate radiopacity, (2) rapid absorption, (3) freedom from chemical irritation, and (4) proper viscosity.

The first substance to adequately fulfill these requirements was presented by Rubin in 1941. This product, which was akin to the radiographic crystalline iodine compounds employed in urology, consists of a solution (70 per cent) of rayopake (diethanolamine salt of 2, 4-dioxo-3-iodo-6 methyl tetrahydropyridine acetic acid) with 3½ per cent concentration of polyvinyl alcohol which produces the viscosity.†

The toxicology was thoroughly studied in dogs. Based on comparative weights, it was estimated that the average amount (10 to 15 c.c.) administered clinically contains one-fiftieth of the maximum tolerated dose of contrast acid and one five-hundredth of the tolerated dose of polyvinyl alcohol.

In his original communication, Rubin reported the use of Visco-Rayopake in 81 patients with eminently satisfactory results. The radiopacity was equal to that of the iodized oils, the contrast material remained in the tubes long enough to permit radiograms to be made, yet it was almost completely absorbed at the end of thirty minutes with very little clinical evidence of local chemical irritation. One patient, in whom the procedure was carried out in the presence of unfavorable clinical conditions, experienced a febrile reaction, but recovered without serious damage to the tubes.

*Presented at a meeting of The Obstetrical Society of Philadelphia, May 3, 1945.

†It was developed according to specifications by Hoffman-LaRoche, Inc., and was called *Visco-Rayopake.*

Since the publication of Rubin's paper, Goldberger has reported the use of Visco-Rayopake in 72 patients, Bernstein in 52 patients, and Norment in 20 patients. Each of these authors shared Rubin's enthusiasm for this new contrast medium.

We have had the opportunity of using Visco-Rayopake in 71 patients. During our early experience, we limited its use to patients whose tubes were closed by previous sterilization operations. Later we extended its use to patients in whom the Rubin test had previously indicated tubal obstruction and, finally, we used it in a small group of patients about whose tubes we had no preliminary information.

All of the patients were hospitalized for part of a day, and each was given 1½ grains of seconal or 3 grains of sodium amytal and $\frac{1}{150}$ grains of atropine sulphate hypodermically about one-half hour before the salpingography was done. Following the procedure, they were confined to bed for three or four hours and then permitted to leave the hospital.

The usual clinical contraindications to uterotubal insufflation were carefully observed, although the test was carried out in the latter half of the menstrual cycle in some of the patients who had been sterilized previously by tubal ligation. Careful aseptic technique was observed in all cases. The cannula was inserted into the cervical canal after the usual vaginal preparation in the operating room, and the patient then transferred to the x-ray department. Under fluoroscopic control, the Visco-Rayopake was carefully injected with a 20 c.c. Luer Lok syringe. This enabled us to observe the freedom with which the fluid medium passed from the endometrial cavity into the tubes, as well as to determine the most favorable time for making the x-ray exposure. In some instances, the opaque material did not enter the tubes until slightly increased pressure was maintained on the plunger of the syringe for a brief period of time, although usually when the uterine tubes were patent it flowed freely without this temporary delay.

As a rule, 3 or 4 c.c. were required to fill the uterine cavity, when the tubes were patent, 10 to 15 c.c. were injected. Stereoscopic films were made in the anteroposterior position at the optimum time as indicated by fluoroscopic observation. In our early experience, we routinely made a flat film one hour later. This invariably failed to show any evidence of the opaque medium, indicating that it had been absorbed. Films made routinely one-half hour after the injection revealed only very slight amounts of the medium remaining in the pelvis, and in many cases it had disappeared completely. This rapid absorption of the Visco-Rayopake from the peritoneal cavity constitutes its most outstanding advantage.

The density of the shadows cast by the Visco-Rayopake was highly satisfactory under the fluoroscope and also on the x-ray films. The excellent visualization of the tubes was made possible, of course, by the high viscosity of this fluid medium which causes it to remain in the tubal lumen long enough to permit x-ray films to be made.

The local discomfort produced by injecting Visco-Rayopake into the uterus and uterine tubes was not marked. In some instances, sharp menstrual-like cramps resulted when the uterine cavity was overdistended by too rapid injection. This was relieved immediately by the withdrawal of a small amount of the fluid. Although an accurate notation of the local pain reaction was not made at the time each patient was studied, it is our impression that most of the patients were aware of some mild discomfort when the contrast medium flowed into the peritoneal cavity. This varied in intensity with the individual patient and usually disappeared within one hour. A few patients stated that it persisted for a longer time. One patient required medication for relief of pain. All of the patients left the hospital within three or four hours. All were examined subsequently and none showed any evidence of local inflammatory reaction.

Two of the patients, whose tubes were closed, were operated upon later. One was found to have bilateral tuberculous salpingitis, but there was no evidence that the injection of the contrast medium had activated the inflammatory process which was quiescent. In the second patient, one tube was resected and transplanted into the uterus. Subsequent salpingography showed this tube to be freely patent.

Of the 79 patients examined by us, the uterine tubes were closed in 54. Twenty-four of these had been sterilized by tubal ligation. In the remaining 30 patients, the tubes were closed at the uterine ends in 8, and at the fimbriated ends in 16, while in 6 one tube was closed at the uterine and one at the fimbriated ends. In 25 patients, the contrast medium passed freely into the peritoneal cavity. One tube was patent in 6, and both tubes were patent in 19.

Preliminary Rubin tests were done in 37 patients. Complete closure was indicated in 27, but in 10 of these uterosalpingography proved both tubes to be freely patent, and in 4 others one tube was patent. In 3 instances in which high pressures during the insufflation test indicated partially occluded tubes, the Visco-Rayopake passed through freely.

It is our impression that uterosalpingography has been regarded generally as a more accurate test of tubal patency than the carbon dioxide insufflation test. However, it has not been used as a routine procedure in some clinics because of the shortcomings of the available media and especially because of the danger of local tissue damage by the commonly used iodized oils, which remain in the tissues for an indefinite period of time. We believe that Visco-Rayopake, as presented by Rubin in 1941, has overcome this difficulty. With such a medium available, gynecologists need have no hesitancy in carrying out hysterosalpingography in all patients in whom uterotubal insufflation indicates obstruction.

Summary

Visco-Rayopake (diethanolamine salt of 2, 4-dioxo-3-iodo-6 methyl tetrahydropyridine acetic acid) a new opaque medium, which was introduced by Rubin in 1941 has been found to be highly satisfactory for x-ray study of the uterine tubes. The outstanding advantage of this substance is due to the fact that it is well tolerated by the tissues and is rapidly absorbed from the peritoneal cavity.

It was used to study the patency of the uterine tubes in 79 patients. In 25 of these, the Visco-Rayopake flowed freely into the peritoneal cavity where it was absorbed within thirty minutes.

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1930 CHESTNUT STREET

THE COMBINED MANCHESTER-WATKINS INTERPOSITION OPERATION IN THE TREATMENT OF PROLAPSE OF THE UTERUS*

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AFTER using various types of operations for prolapse of the uterus in this Service, preference is now given to the Manchester type for the first- and second-degree varieties, and vaginal hysterectomy for third-degree prolapse cases. The Watkins interposition operation alone is used only for large cystoceles without prolapse of the uterus, for when this operation is done for prolapse of the uterus, recurrence of the prolapse may occur. It is disappointing to do a Watkins interposition operation and get a good result with a cystocele but have the cervix down to the vaginal orifice later. As Phaneuf[1] and others have pointed out, this is more likely to happen if the uterus is atrophied. It is equally disappointing to obtain a good result in the treatment of prolapse of the uterus with the Manchester operation and later have recurrence of the cystocele. My greatest difficulty with the Manchester operation has been in the cases where the cystocele predominates. In marked cystocele, as in any hernia, the fascia is usually so thinned that it is difficult to get sufficient support for the bladder, particularly in the atrophy of old age. To overcome these difficulties, a combination of the Manchester operation with the Watkins interposition procedure has been used in treating first- or second-degree prolapse when accompanied by a very large cystocele.

Technique

The Manchester operation is carried out in the usual way with or without amputation of the cervix depending on its condition and the amount of elongation present. However, amputation is done in the great majority of the cases. The sutures in the stumps of the divided cardinal ligaments are placed, but not tied. The anterior cul-de-sac is then opened and the uterine fundus brought out and interposed, as in the Watkins procedure. All sutures are then tied and the operation completed by doing a high posterior colporrhaphy to narrow the vagina and to care for a high rectocele. This is followed by a perineorrhaphy. The tissues surrounding the vagina, particularly in the upper half, contribute much to the support of the uterus, as shown by Mengert.[2] In prolapse after hysterectomy this fact is applied, for either incomplete or complete obliteration of the vagina by the Le Fort operation or total colpectomy is utilized in effecting a cure. As the vagina is enlarged in all prolapse cases, narrowing of the vagina by high posterior colporrhaphy and perineorrhaphy is a valuable procedure in any prolapse operation. The extent of the operative narrowing of the vagina depends upon the marital status of the patient. If there is urethrocele or relaxation around the neck of the bladder with stress incontinence, either the Kelly plication or the Kennedy operations are done preliminary to interposition of the uterus. The interposition operation should not be done in women in the childbearing period unless the patient is sterilized.

My first combined Manchester-Watkins interposition operation was done in 1939. In Richardson's[3] composite operation the interposition principle is used,

*Read before the Pittsburgh Obstetrical and Gynecological Society, Oct. 1, 1945.

for the cervix and fundus uteri are removed except a disk of cervix at the internal os which is interposed between the bladder and the vaginal fascia and mucosa. In 1939, Schumann[4] referred to the combination of the Manchester and Watkins operations. In Crossen and Crossen's *Operative Gynecology*,[5] the combined procedure is also advocated. No doubt many others use this principle, but I am calling attention again to its value in the operative treatment of prolapsus uteri when the cystocele is marked and the tissues are thinned.

Results

There were 230 patients operated on for prolapse of the uterus from 1934 to 1944. There were 15 combined Manchester-Watkins interposition operations in this series, and all of them were done since 1939. The low incidence of this type of operation is due to the fact that it was used only in first- and second-degree prolapse in which the cystocele was particularly large and the tissues atrophied, and when there was doubt as to whether the usual operation would suffice to correct the cystocele permanently.

In a follow-up study, ten of the fifteen patients were contacted. One patient, a woman 72 years of age with cardiovascular disease, withstood the operation well but died at home of coronary thrombosis three weeks after leaving the hospital. Eight patients reported themselves as well, and the one patient listed as improved complained only of backache, leucorrhea, and dizziness. The anatomic results were good in all of them and, although the cystocele predominated before operation, there was no recurrence of cystocele or prolapse. The results have been very satisfactory in our small experience with the combined Manchester-Watkins interposition operation and it has helped to solve the problem of the large cystocele and prolapse of the uterus better than either operation alone. It has not been used in third-degree prolapse.

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NEONATAL THROMBOCYTOPENIC PURPURA

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PURPURA was first described by Paul Gottlieb Werlhof in 1735 and was known as "Werlhof's disease." However, it was not until 1887 that Denys, a Belgian histologist, pointed out the almost complete absence of platelets from the blood of certain patients with purpura, and thus separated the thrombocytopenic form of the disease. Dohrn described the first case in the newborn in the same year (1887).

Interest in the disease in the neonatal period was not aroused until 1925, when Rushmore reporting on purpura in pregnant women detailed six cases from the literature. The neonatal cases were merely "riders" to the maternal reports. Since then, ten additional cases have been recorded. The rarity of the disease prompted this report.

Case Report

Mrs. G. C., Hospital No. 41-14962, aged 34 years, height 5 feet 1 inch; weight 285 pounds, gravida viii, para v, came to the Outclinic on March 21, 1944, complaining of a "tumor in the abdomen," which was proved to be a "near-term pregnancy."

Elective induction of labor was begun the following evening with 100 mg. stilbestrol orally, and the next morning 1 ounce of castor oil and a soapsuds enema were given. Three hours later the membranes ruptured spontaneously and pains began.

Labor was precipitate (2 hours and 34 minutes) but otherwise uneventful except for difficulty in delivering the large shoulders.

The child, a boy, cried spontaneously but remained dusky. Oxygen, administered for several minutes, failed to clear the cyanosis. Physical examination revealed a normally developed, cyanotic male infant weighing 4,880 grams. The length was 53 cm., the sitting height 38 cm., and the head measurements were within normal limits. The cyanosis cleared considerably in the first twenty-four hours of life.

Thirty-eight hours after birth, the child passed a meconium stool with some blood. Synkamin, 0.5 mg., was given subcutaneously. Three hours later, the baby began to have frequent stools of dark-reddish to black feces that appeared to be meconium mixed with old blood. Later, they were more reddish in color. No blood clots were observed. After repeated plain water enemas, protoscopic examination revealed no bleeding points.

Blood drawn at this time gave the following values:

Total red blood cells	4,630,000
Total white blood cells	19,050
Differential	
Neutrophiles	74 per cent
Band neutrophiles	10 per cent
Lymphocytes	16 per cent
Bleeding time (Duke's Method)	1½ minutes
Coagulation time (Sabraze's Method)	5½-6½ minutes
Fragility of the red cells	0.50-0.34 per cent NaCl
Clot retractility	1+
Platelets (average of several counts)	21,000
Hematocrit	51.5 per cent

Reticulocytes	1.3 per cent
Van den Bergh (direct)	11.3
Blood cultures (reported later)	No growth

The Rumpel-Leede arm-band test was questionably positive. Both mother and child were Rh positive. Prothrombin times were as follows:

At 5 hours of age—47 per cent of normal.
At 29 hours of age—38 per cent of normal.
At 53 hours of age (15 hours after vitamin K administration)—97 per cent of normal.

Seven hours after the initial rectal bleeding, a bruised-appearing bluish area, 1.0 cm. in diameter, appeared over the spinous processes from the eleventh thoracic to the last lumbar vertebra. Small petechiae were present about the neck and the upper back.

The rectal bleeding continued for thirteen hours, or until 100 c.c. of citrated whole blood had been given intravenously. Following this, there was no more bleeding from the rectum. A second bruised area, 3.0 cm. in diameter, appeared on the right upper anterior thoracic wall soon after the transfusion.

During the next twenty-four hours, numerous petechiae appeared over the entire body, including the conjunctivae and sclerae.

Four days after the onset, the petechiae and bruised areas began to fade and were practically gone within twenty-four hours. Fracture of the right clavicle was diagnosed, proved by x-ray, and treated with a figure-of-eight halter.

The child was drowsy during his entire hospital stay. On the fifteen day he became more listless, appeared sleepy, and showed slight fever (101.4° F. by axilla) that persisted for seven days. There was no adequate explanation for this febrile course.

Platelet determinations on the mother were always normal. Her postpartum course was uneventful. No medication had been given during this pregnancy nor had there been any complications. In fact, she thought she had a tumor, and due to her obesity it was necessary to confirm the diagnosis of pregnancy by x-ray. She did not bruise easily but her husband reported that he always had. There was no history of a similar episode in any of the siblings.

The baby was discharged on the twenty-eighth day weighing 5,210 grams, 330 grams above birth weight. The platelet count was 100,000 per cubic millimeter. The platelet determinations were as follows:

3/25/44	21,800	4/12/44	113,700
3/28/44	40,800	4/15/44	113,600
3/30/44	72,800	4/18/44	100,000
4/ 2/44	134,200	5/ 6/44	126,400
4/ 6/44	170,500	8/ 2/44	165,000
4/ 8/44	226,000	3/12/45	250,000

The child was returned to the hospital on May 6, 1944, at the age of six weeks. There had been no bleeding or other abnormality. He was more active, cried some, and appeared to be interested in things about him, in contrast to the listless attitude in the first month of life. On physical examination, the findings were normal; the fracture was well healed. The thrombocyte count was 126,400 per cubic millimeter.

On July 31, 1944, he was admitted to the hospital with acute suppurating otitis media which responded well to therapy. A platelet count revealed 165,000 per cubic millimeter.

On his first birthday, March 22, 1945, he was seen again. The mother reported that he had had whooping cough during November, 1944. There had been no bleeding. The present complaint was "ear trouble." Examination revealed subacute otitis media. The parents refused hospital therapy and medical treatment was carried out at home. The clavicle was so well healed that the records had to be consulted to ascertain the site of the old fracture. The thrombocyte count was normal.

Discussion

It would be hazardous to deduce or conclude anything about the disease as it appears in newborn infants. There are only sixteen other available case reports, some of which lack data about the newborn because the main interest concerned thrombocytopenic purpura in the pregnant woman, the baby's case being a minor feature of the presentation. Many of the earlier cases lack laboratory data essential to the diagnosis of thrombocytopenia.

The material from the literature has been summarized in Tables I and II.

TABLE I

											SYMPTOMS											
		MOTHER										BLEEDING FROM OR INTO										
CASE NO.	BIBLIOGRAPHY	AGE	PARITY	PURPURA	PURPURA IN OTHER CHILD.	SEX	WEIGHT	LENGTH	SITTING HT.	AGE AT ONSET	SKIN	RECTUM	ORAL MUCOUS MEMBRANE	VOMITUS	URINE	CONJUNCTIVA	VAGINA	TEMPERATURE	RUMPEL-LEEDE	SPLENOMEGALY	OTHER
1	Dohrn	40	2	+		F	2,370	43		B*	+		+			+					
2	Hanot									S†	+		+								
3	Hanot	32		+						S	+										
4	Zangemeister	25	1	+						S		+	+								
5	Mosher	36	6	+	0	F	2,927			B	+										
6	Waltner	30		+		F	1,800			B	+										
7	Liebling	22	1	+		F	3,940			B	+			+	+		+	101°			
8	Greenwald					M				14th day	+	+	+						+	0	Liver enlarged
9	Siegler	29	3	+		F	4,819														
10	Brown			+		Said to have classic signs and symptoms																
11	Sanford	22	1	+		F	3,608	51	32	B	+			+				101°			
12	Davidson	21	1	+		F	3,470	53		B	+	+	+	+	0		+				
13	Whitney	26	1	+	+	M	2,849			B	+									0	
14	Whitney	28	2	+	+	M	2,424			B	+		+							0	
15	Finn		1	+	+		3,100			B	+			+							
16	Finn		2	+	+		3,100			B	+										
17	Author	34	8	0	0	M	4,880	53	38	B	+	+	+	0	0	+		101°	?	0	

*B—Birth.
†S—Stillborn.

The disease would appear to be transferred from the mother to the child, since all the reports (except our own), which contain information on the subject, mention the presence of the disease also in the mother. However, the recognition of more cases in newborn infants may alter this concept. Possibly, many cases remain unrecognized because of the paucity of data regarding occurrence and manifestations of the disease. Obviously, the disease may occur in a milder form, with such scanty signs that attention is not directed to the blood.

Most cases have involved first-born children. Fifty per cent of the mothers were primigravidas, 25 per cent were secundigravidas, and in two women the first two children were affected.[13, 17]

The birth weight does not appear significant. The average was 3,107 grams.

Sex would appear to be a factor; there were seven females and four males. However, the prognosis is better in females. Our case is the only reported male to survive (25 per cent), whereas five of the females lived (71 per cent).

TABLE II

CASE NO.	BIBLIOGRAPHY	LABORATORY							THERAPY	RESULTS
		PLATELETS	TOTAL R.B.C. (MILLIONS)	TOTAL W.B.C. (THOUSANDS)	HEMOGLOBIN (GRAMS)	BLEEDING TIME (MINUTES)	COAGULATION TIME (MINUTES)	CLOT RETRACTIVITY		
1	Dohrn								None	Lived
2	Hanot								None	Stillborn
3	Hanot								None	Stillborn
4	Zangemeister								None	Stillborn
5	Mosher								None	Died
6	Waltner	90,000	5.6	8.2	100 per cent	12	10	None	None	Lived
7	Liebling	40,000	6.0		110 per cent				5 c.c. thromboplastin	Lived
8	Greenwald	30,000	6.1	12.0	20	5	35	None	None	Died
9	Siegler								None	Died
10	Brown								??	??
11	Sanford	20,000	5.8	16.0	18		Normal		None	Lived
12	Davidson	56,000	5.1	42.7	24	3	7	None	60 c.c. citrated transfusion. Bothrop antitoxin	Lived
13	Whitney	80,000				1	3.5		20 c.c. transfusion	Died
14	Whitney	90,000	5.5	12.9		11	1.5		55 c.c. vitamins K and C	Died
15	Finn	120,000	5.4			7	3		None	Died
16	Finn	40,000							None	Lived
17	Author	21,800	4.6	19.0	17	1.5	4	1+	100 c.c. transfusion. 0.5 mg. vitamin K	Lived

Practically the only sign is bleeding into the skin or from one of the body portals. Splenomegaly was not reported in a single instance but was noted as absent in four cases. The Rumpel-Leede test was positive only once; it was questionable in our case. Temperatures of 101° F. were recorded in three cases but their significance is unknown. The disease was always present at or soon after birth, except in one fatal case when it appeared on the fourteenth day. This was the only child with a positive Rumpel-Leede's sign and an enlarged liver.

The skin is the most frequent site of bleeding, which takes the form of petechiae or ecchymoses; such manifestations are recorded in 14 cases, or 88 per cent, and no report denies their presence.

The second most frequent site is the gastrointestinal tract, especially the oral mucous membranes where bleeding is more obvious than in the vomitus or stools. Bleeding from the conjunctivae and vagina is less frequent (two cases each). Hematuria is reported once.

The normal platelet count in the newborn is the same as in the adult.[16] It is generally accepted that in the adult bleeding does not occur on the basis of thrombocytopenia unless the platelet count falls to 100,000 or below. The average count in the reported neonatal cases is 58,600 per cubic millimeter. It

appears that the lower platelet counts carry a better prognosis. The average count for the surviving children was 44,333 as compared with 77,333 for the deceased. One child who died and one who survived had counts disagreeing with this concept. With these exceptions, all babies lived who had counts of 56,000, or below, while those who did not survive had counts of 80,000, or above.

In the entire group there were three stillbirths, six children died from the disease, and seven survived. (The outcome in one case is not reported.) This represents 44 per cent survival.

The red blood cell count and hemoglobin determinations are within normal limits for the newborn infant.

Bleeding and coagulation times varied so widely that no conclusions can be drawn. The average bleeding time was 5.7 minutes and the average coagulation time 9 minutes.

The majority of the children received no therapy. Four patients have been treated with transfusions. Davidson gave 60 c.c. of citrated blood but the child continued to bleed until "Bothrop antitoxin" was administered. This child survived. Whitney used blood transfusions in two cases. In the first, 20 c.c. were given and there was no bleeding for two days following the transfusion, but the child died on the third day of intracranial hemorrhage. In the second case, 55 c.c. of blood were given in addition to 1.0 mg. of vitamin K, 100 mg. of ascorbic acid, and 2 c.c. of Koagamin, but the child died twenty-four hours after birth. Our patient was given 100 c.c. of citrated whole blood and 0.5 mg. of vitamin K. The bleeding stopped permanently following the transfusion. Liebling used 5 c.c. of thromboplastin and reports the child normal on the twelfth day.

Postmortem examinations on six infants failed to show any significant lesions except extravasation of blood into various parts of the body.

Summary

A case of thrombocytopenic purpura in a newborn infant is reported. The mother was unaffected. The literature has been reviewed and summarized. It appears that in the newborn the disease is manifested by bleeding (especially into the skin) and thrombocytopenia. The prognosis is poor.

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ACUTE LYMPHATIC LEUCEMIA OCCURRING DURING PREGNANCY

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CASES of leucemia in pregnancy are very rare. Since we have had the opportunity to observe one recently, it was felt that it should be presented; and we believe this report will bring the authenticated cases of pregnancy complicating leucemia to a total of eighty-one. After reviewing the available literature, we have found that the most recent and up-to-date summary of the variously reported comparable cases was made by McGoldrick and Lapp[1] in November of 1943. Including their own case report, they gave a total of eighty authenticated cases of leucemia during pregnancy. Since their article we have been able to find no other reports.

Case Report

The patient was a 23-year-old white gravida ii, para i. Her first pregnancy, which ended in a normal delivery of an 8-pound 3-ounce baby in 1940, was entirely uneventful. The child is living and well at this time. The patient's past history was essentially negative except for tonsillitis in 1940. The second pregnancy began about March 5, 1944, and progressed normally up until June, when she complained of a severe sore throat and was given sulfadiazine medication. At this time her red blood count was 4,000,000 and the hemoglobin 84 per cent. About two months later she was again seen with a severe sore throat, fever, cough, weakness, malaise, and shortness of breath. It is believed that during this period, from June until August, the leucemia began. In August she was again put on sulfadiazine. Five weeks later she was seen again and now had edema, while the previous weakness and shortness of breath persisted. Three weeks later, about November 2, she was admitted to an Army hospital in Georgia, where blood studies revealed her red blood count to be 2,500,000; hemoglobin, 40 per cent; white cell count, 28,000; lymphocytes, 87 per cent; and neutrophiles, 3 per cent (see Fig. 2). Physical examination on this date revealed numerous small recent hemorrhages in the conjunctiva, very pale gums, and mucous membranes. There were also a few palpable cervical lymph nodes. The uterus was enlarged to about three fingers below the xiphoid.

Five days later blood studies showed the red blood count to be 1,310,000; hemoglobin, 34 per cent; white blood count 33,950. Differential count showed segmented cells 2 per cent, juveniles 6 per cent, stab forms 1 per cent, myelocytes 45 per cent, premyelocytes 40 per cent, and myeloblasts 11 per cent. Three days after this the patient was given 250 c.c. of whole blood as a transfusion, and was transferred by airplane to Walter Reed General Hospital for possible deep x-ray therapy.

Upon admission to Walter Reed General Hospital the following day (November 11), physical findings were essentially as noted above with the following additions: tonsils were enlarged, the gums were a little swollen and spongy, and two palpable glands were noted at the angle of the jaw. A diagnosis of acute lymphatic leucemia was made. Irradiation was contraindicated. On December 8, 1944, the gums had become markedly spongy and thickened and of a deep-bluish cyanotic color and extended down, almost completely covering the teeth. A small ulcer developed on them at this time. A moderate retinal hemorrhage occurred in the right eye.

The pregnancy itself was progressing normally. The main problem in this case at this particular time was to determine exactly when and how to deliver the patient. Three

possibilities were considered: first, to section the patient as soon as it was felt that the baby was viable; second, to allow the patient to proceed to as near to term as possible and to perform an elective section; or, third, to allow the patient to proceed to term and deliver spontaneously.

The first possibility was ruled out because the patient was responding well to treatment, and we felt that she would probably continue to respond for the next few months. It was also felt that since her disease would obviously terminate fatally, every reasonable chance should be given for a healthy, live baby at term.

The second method of treatment was to be considered seriously in case the patient should develop toxemia or the leucemia should grow worse. This method had been used before successfully by others, as reported by Moloney[2] in 1943. However, this patient's clinical condition remained good. It was eventually proved that her life would have been materially shortened had cesarean section been performed, as the perineal laceration completely failed to heal and, in all probability, the abdominal incision would likewise have failed to heal.

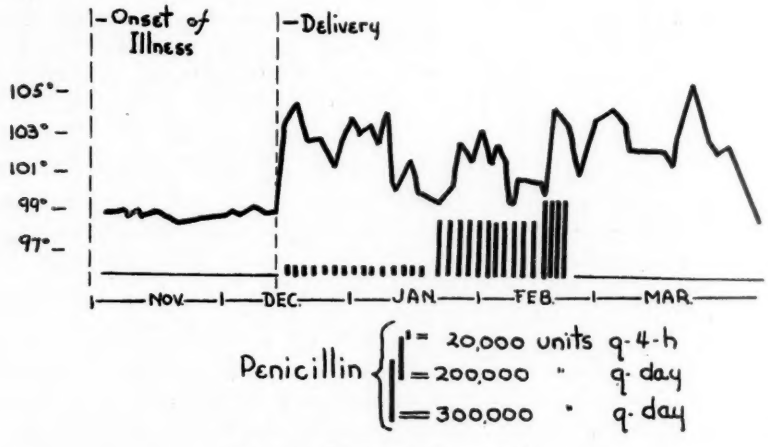

Fig. 1.—Temperature record.

The third method of delivery was decided upon because (1) her clinical course was running quite satisfactorily; (2) she had previously delivered an 8-pound baby quite normally; (3) it was felt that this baby, if anything, was smaller than 8 pounds; and (4) hemorrhage, if it should occur, could be adequately controlled from below.

The possibility of postmortem section was considered and preparations made in the event this should be necessary.

From December 8 to 18 the patient's course was satisfactory. During the foregoing five weeks she had been given a total of twelve whole blood transfusions, and an effort was made to keep the blood picture as normal as possible. About 2 A.M. on December 18 she went into spontaneous labor, which was short and uneventful. After three and one-fourth hours of normal labor she delivered spontaneously a 7-pound, 4½-ounce female infant, which cried immediately and appeared perfectly normal. Immediately following delivery, the patient was given $\frac{1}{320}$ grain of ergotrate intravenously and 1 c.c. of pitocin intramuscularly. The placenta separated and was expelled intact. Hemorrhage amounted to about 600 c.c. The uterus was packed and the second-degree laceration was repaired with No. 00 chromic catgut, using interrupted mattress sutures. On the following day the packing was removed and was followed by only very minimal bleeding. It was noted at this time that three large hematomas had developed, one in each labium majus and one in the perineum.

The patient's postpartum course, as expected, was very stormy. On the second postpartum day her temperature rose to 104.8° F., at which time she was placed on penicillin therapy (see Fig. 1). Ten days later the perineal sutures were removed. There was no evidence of any absorption whatsoever of the catgut; the lacerated area was infected and

covered with a grayfish fibrin coating and showed no evidence of healing. From the second to the fifth postpartum week, the patient continued to receive frequent whole blood transfusions and penicillin therapy. During this time she made a remarkable clinical improvement. Her gums receded almost back to their normal size, and her blood picture improved temporarily. She lived for one more month, during which time the blood picture took a rapid and sharp turn for the worse in spite of transfusions. Confluent petechiae developed over the medial surface of both lower legs. Her condition gradually became progressively worse, accompanied by loss of weight and general malaise, and she died in a coma on March 25, 1945.

The infant remained in the hospital from the date of her birth until her mother's death. Numerous blood studies consistently revealed normal findings. Upon discharge she weighed over 11 pounds and was perfectly healthy.

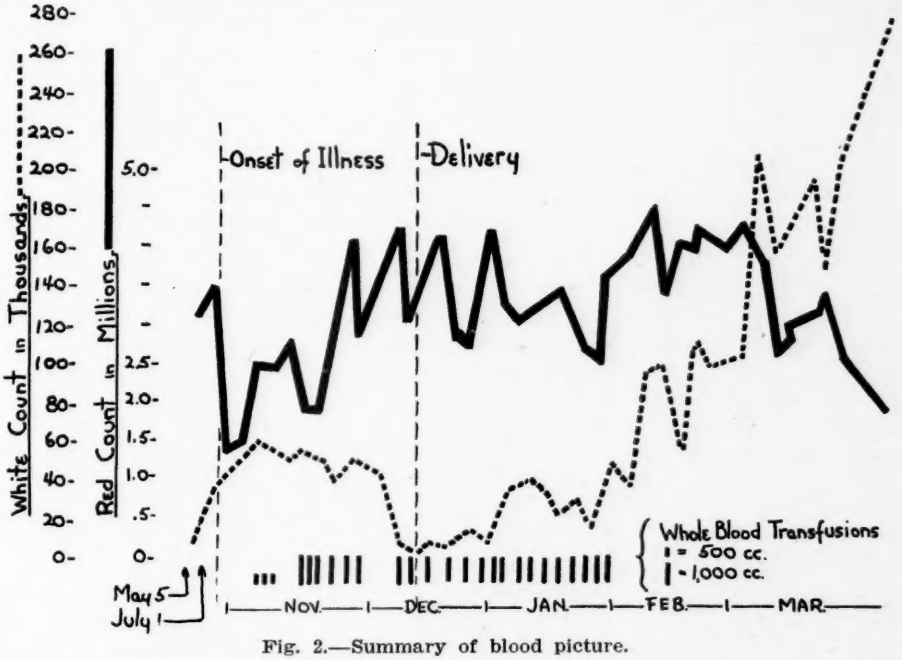

Fig. 2.—Summary of blood picture.

Summary of Laboratory Data and Treatments

A diagnosis of acute lymphatic leucemia was made. X-ray therapy was contraindicated. The patient received a total of twenty-five transfusions, by means of which her blood level was relatively well controlled (see Fig. 2). At the onset of her illness in early May, the white blood count was 8,000. This gradually rose and on November 24 was 56,000. Early in February, it rose to 62,000 and during the last month of her life ranged from about 100,000 to 265,000. Her differential white blood cell study ranged from 85 to 100 per cent lymphocytic cells with the immature young forms ranging from 85 to 95 per cent.

The patient was found to belong to blood group A, her Rh factor was positive, and there was no Rh antibody found. The infant was likewise found to belong to blood group A and to be Rh positive.

During the last three months of the patient's life, she received a total of 3,580,000 units of penicillin (see Fig. 1).

Pathologic Report of Placenta.—Gross: Specimen consists of placenta with membranes and cord intact, which show nothing of significance.

Microscopic: The placenta generally is moderately anemic with no evidence of infarction or leucemic infiltration in the maternal or fetal portions. The cord shows nothing of note.

Diagnosis: Essentially normal placenta showing no evidence of leucemic infiltration.

Autopsy Findings

General.—The body was that of a well-developed, moderately emaciated white woman, 24 years old, whose length was 165 cm. and estimated weight 85 pounds. There was a normal distribution of dark hair on the head and multiple petechial hemorrhages were seen over the skin surfaces, most numerous over the lower arms and lower legs. There was evidence of old subconjunctival petechiae on either side but no recent hemorrhages were seen. The teeth were in good repair, and the mucous membranes were pale, slightly swollen, and exhibited petechial hemorrhages. Lymph nodes in the cervical, axillary, and inguinal regions were enlarged moderately, discrete, and firm. The abdomen was slightly distended and there was an opened, unhealed, postpartum tear in the left posterior quadrant of the vaginal orifice and adjacent perineum. This was covered with a small amount of hemorrhagic fibrinous exudate. The extremities exhibited marked emaciation and slight cyanosis of the nailbeds with the above-mentioned petechial hemorrhages. Rigor and postmortem lividity were marked.

Primary Incision.—Subcutaneous fat over the chest and abdomen was depleted. The musculature was moderately atrophic. On opening the peritoneal cavity, multiple petechial hemorrhages were found on its surfaces, and it contained approximately 300 c.c. of clear straw-colored fluid. The lymph nodes in the omentum and mesentery were enlarged to three to four times the normal diameter, and they were replaced by grayish firm neoplastic material. The nodes along the periaortic region were markedly enlarged, confluent, and formed bilateral masses almost as large as the diameter of the aorta. The liver was 3 cm. below the right costal margin in the midclavicular line and 8 cm. below the xiphoid. The left pleural cavity contained approximately 300 c.c. of slightly blood-tinged fluid, and the right was dry. On both sides the surfaces exhibited scattered petechiae, and on opening the pericardial sac it exhibited similar hemorrhages together with the fluid content of 300 c.c.

Thorax.—Lungs: Right weighed 496 grams, and the left, 414 grams. Their external surfaces were grayish pink and the lower lobes were devoid of crepitation, being rather firm. On section both lower lobes exhibited a rather firm parenchyma with moderate increase in fluid, but there was no evidence of pneumonic consolidation. The upper lobes were essentially normal except for a slight increase in fluid.

Heart: Weighed 248 grams. On its epicardial surface there were occasional scattered petechiae. The myocardium was firm and all chambers were markedly dilated. On the endocardial surfaces of the left ventricle there were several 5 mm. hemorrhages. The valvular structures were essentially normal.

Abdomen.—Liver: Weighed 2,606 grams. It had a light brick-red color with a smooth, dense capsule. On section, the parenchyma was swollen, firm, brick-red, and, other than a 2 cm. grayish nodule in the outer portion of the left lobe, there were no gross evidences of neoplasia.

Spleen: Weighed 1,195 grams and externally over its upper half there was an irregular 6 cm. area of hemorrhage beneath the capsule. The organ was firm and its capsule was pale and tense. On section, an area of infarction in its upper half was found, the area being yellowish and with irregular borders, but it was well circumscribed. The remaining portion of the parenchyma was light brick-red, swollen, firm, and dry. Normal markings were completely obliterated.

Gastrointestinal tract: In the mucosal surfaces throughout they exhibited scattered petechial hemorrhages and a small amount of coffee-ground material was found in the small and large intestine.

Pancreas: Weighed 90 grams, and on section had a light brownish color in contrast to the normal bright yellow.

Kidneys: Right weighed 145 grams and the left, 142 grams. Their capsules stripped easily, revealing occasional subcapsular petechia and pale yellowish smooth renal surfaces. A 1 cm. area of infarction was found in the cortex at the right lower pole. On sectioning, the cortex of either organ was yellowish, pale, and approximately twice normal thickness. The medullary portions, calices, and pelves were essentially normal.

Uterus and adnexa: External surface of the uterus was normal and its size was that of a normal uterus. On opening the uterine cavity it was found to be smooth, grayish, and essentially normal. A small area of brownish pigmentation was seen in the lower third. The Fallopian tubes appeared normal. The ovaries were 1.5 cm. in diameter and flattened, and appeared to be moderately atrophic.

Neck.—The lymph nodes in the cervical regions were moderately large, like those seen elsewhere; otherwise, structures of the neck, including the thyroid, appeared to be normal.

Anatomic Diagnosis.—Leucemia. Postpartum unhealed perineal defect.

Microscopic.—Lymph node: Exhibited extensive replacement of its normal structure by diffuse infiltration of immature lymphoid cells, many of which were lymphoblasts. The sinusoids were filled with these cells and the peripheral sinus was invaded by similar cells. Only a few remnants of lymph follicles remained.

Spleen: Exhibited a similar picture to that seen in the lymph node. The normal structures were largely wiped out, and there was diffuse replacement by a rather dense infiltration of immature lymphoid cells. The Malpighian corpuscles were obliterated for the most part, and there were rather large areas which exhibited areas of early infarction. The appearance was typical of lymphoid leucemia.

Uterus: Exhibited a moderate endometrial atrophy, the glands being rather wide apart and separated by loose stroma. Scattered through the subendometrial areas and deeper muscular layers there were scattered hemosiderin laden macrophages secondary to postpartum involution.

Ovaries: Showed no significant abnormalities.

The kidneys, the adrenals, and the heart showed scattered and minimal areas of infiltration by leucemic cells similar to those seen elsewhere. The appendix, liver, lungs, and diaphragm showed extensive and diffuse lymphatic infiltration.

Comment

The disease in this case apparently began in the first or second month of pregnancy. The pregnancy itself had no obvious effect on the course of the illness. Irradiation therapy in this case was contraindicated when the diagnosis of acute lymphatic leucemia was made, and the patient was carried successfully to term and for four months post partum by successive transfusions of whole blood. Because of the immediate elevation of temperature following delivery, penicillin therapy was instituted, and the patient was given a total dosage of over 3,000,000 units during a period of eight weeks. It is believed that while the penicillin obviously had no direct beneficial effect on the course of the leucemia, it did keep to a minimum the secondary infection of the lacerated perineum and possibly prolonged the patient's life by preventing puerperal infection.

The problem of how to deliver this patient when she was first seen during the last trimester was solved in this particular case by permitting her to carry the pregnancy to term rather than to interrupt the pregnancy and deliver her by section when the infant had obtained a viable age. As has been observed in the past experience of other authors, postpartum hemorrhage, contrary to expectation, was easily controlled.

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TUBERCULOUS ULCER OF THE VULVA

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TUBERCULOSIS is one of the infrequent diseases affecting the external genitals of the female. Haas[1] noted one case of vulval tuberculosis among sixty-two cases of genital tuberculosis collected over a period of twenty years. Norris[2] found the external genitals involved in 1 to 2 per cent of cases of gynecologic tuberculosis. Most of the cases were discovered at autopsy and were part of a generalized tuberculosis. Furthermore, few cases have been reported in the American literature. Recently, a case of tuberculous ulcer of the vulva was seen on this service. In view of the rarity of the lesion as well as the end result with therapy, it was decided to report this case.

The patient, B. M., a 35-year-old Negro housewife, was admitted to the Gynecologic Service of Bellevue Hospital on Nov. 9, 1944, with the following complaints: ulcer of right labium minus, weakness and 20-pound weight loss in past year, fever, low back pain, and left sternoclavicular pain.

Past History.—

Medical: Asthma of fourteen years' duration. Syphilis and gonorrhea denied. Patient stated she had never been pregnant.

Surgical: In February, 1939, a total hysterectomy and bilateral salpingo-oophorectomy was performed at a North Carolina hospital. Her admission complaints at that time were dysmenorrhea, oligomenorrhea, and a sense of fullness in the lower abdomen. The discharge diagnosis was bilateral pyosalpingitis. Pathologic examination of the excised tissues was not done. A chest x-ray at that time showed increased density in the hilar regions, but both lung fields were reported as otherwise negative.

Family History.—There was no familial history of tuberculosis or of contact tuberculosis. An aunt had died of breast cancer.

Present Illness.—Four months prior to admission the patient first noticed a "growth" which became larger, and was painful and tender. No bleeding occurred from this area. For the past three months she had suffered from pain in her lower back and in the left sternoclavicular region radiating to the left arm and chest. She also complained of nocturia (two to three times), urgency and burning on urination, as well as a fullness in the bladder after voiding. No gross hematuria was present at any time.

Physical examination revealed a poorly nourished and poorly developed Negro woman appearing chronically ill and showing evidence of marked weight loss. Temperature, 99° F.; pulse, 104; respiration, 24. The chest was symmetrical. A semifluctuant, ill-defined mass was present over the left sternoclavicular junction. Auscultation of the lungs revealed occasional wheezes in both posterior bases. The heart was unremarkable. The abdomen was moderately distended and tympanitic, with a doughy feel. No tenderness was present. No mass was palpable. Some shotty posterior cervical and axillary lymph nodes were present. The inguinal nodes were bilaterally enlarged, firm, and nontender.

Pelvic examination showed a 1 cm. ulcer on the right labium minus. The ulcer was irregular in outline, tender, superficial, moderately clean, with a slightly raised border. There was no surrounding induration. The vagina was foreshortened. The uterus and adnexa were

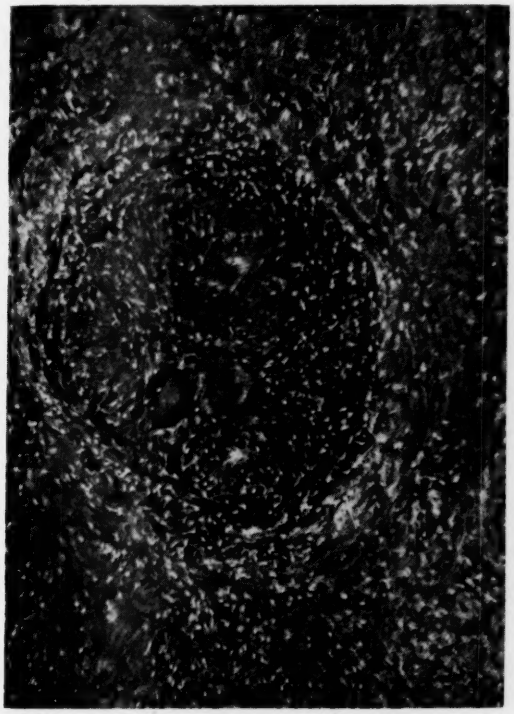

Fig. 1.—Discrete tubercle formation in floor of vulval ulcer (low power).

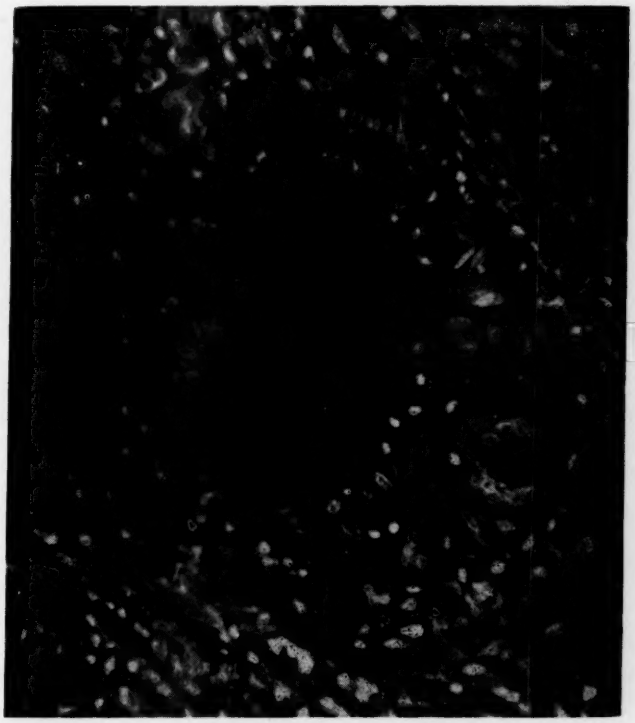

Fig. 2.—Typical giant cells of tuberculosis with peripherally placed nuclei in vulval ulcer (high power).

not palpable, having been removed. Speculum examination showed no cervix to be present. Several small tabs of normal-appearing vaginal mucosa were seen in the vaginal vault, the result of a cicatrix from the previous operation.

Laboratory Data.—White blood cells, 7,300; polys, 66 per cent; lymphocytes, 34 per cent; red blood cells, 4.3 million; hemoglobin, 12.5 grams. Urinalysis and Wassermann reaction were negative. Erythrocyte sedimentation rate was ten minutes. Repeated tests on sputum, gastric contents, and urines were negative for tubercle bacilli. A dark-field examination of the ulcer was negative. The Frei and Ducrey skin tests were negative. Chest x-ray showed enlargement of the hilar shadows and a diffuse scattering of small nodular lesions throughout both lungs. These lesions were interpreted as being due to a hematogenous spread of tuberculosis. X-rays of the hands and feet showed no evidence of Boeck's sarcoid or other pathology. Excretory urography revealed the contrast medium in both urinary tracts with no gross abnormalities.

A provisional diagnosis of tuberculous ulcer of the vulva or early vulval carcinoma associated with a tuberculous peritonitis was made. An attempted aspiration of the fluctuant area over the left sternoclavicular joint was done without success because of lack of cooperation by the patient. No fluid was obtained. On November 16, a block excision of the right labial ulcer was done under novocain anesthesia for diagnostic purposes.

The pathologic report (Acc. No. 2969/44) was tuberculous ulcer of the vulva. Many discrete tubercles with an outer lymphocytic ring and an inner area of granular necrosis were seen. Typical tuberculous giant cells were present with peripherally arranged nuclei and many cytoplasmic processes. (Figs. 1 and 2.) The operative wound healed well by first intention.

The patient ran a morbid course during her hospital stay, with mouth temperatures varying from 97° to 102° F. She was transferred to the Tuberculosis Service, but signed out against advice on Dec. 15, 1944, three weeks after transfer. She stated she was returning to North Carolina. We have been unable to locate the patient since.

Discussion

The question as to whether tuberculosis of the vulva is primary or secondary to a tuberculous focus elsewhere is still unsettled. Although the squamous epithelium of the vulva and vagina is resistant to external inoculation by the tubercle bacillus, tuberculous lesions of the vagina have been produced in guinea pigs by placing virulent organisms in contact with the vaginal walls.[3] Furthermore, five cases of tuberculosis of the vulva have been collected by Marc Schmid[4] suggesting a primary origin. All of the cases occurred very soon after cohabitation. Three of the men had tuberculous epididymitis; the other two had open lung lesions. The occurrence of primary vulval tuberculosis is, therefore, a possibility, but can only be proved by eliminating the probable presence of tuberculosis elsewhere in the body. Jameson[3] states: "The most minute clinical study with negative findings is insufficient to warrant a diagnosis of primary tuberculosis of the vulva or vagina, for it is often by the microscope alone that one is able to discover tuberculosis in other organs." Secondary tuberculosis of the vagina has occurred by spread from tuberculous foci through the blood, lymph, or by direct extension[3] and the vulva is probably involved secondarily in a similar fashion.

The diagnosis cannot be made by inspection alone. There are no typical clinical findings pathognomonic of tuberculous ulcer of the vulva. If the ulcer is of very recent origin and small in size, chancre, soft chancre or chancroid, granuloma inguinale, and the "primary lesion" of lymphogranuloma inguinale must be excluded. This is accomplished by dark-field studies, serologic tests for syphilis, smears for Ducrey bacilli and Donovan bodies, and the Ducrey and Frei skin tests. When the lesion has been present for a longer time, one must also exclude carcinoma and gumma by histologic sections of a biopsy and

serologic tests for syphilis. Finally, the diagnosis of a tuberculous ulcer is established by the characteristic histologic findings in tissue obtained by biopsy. Forty-eight per cent of patients with genital tuberculosis show evidence of tuberculosis elsewhere.[2] Suppuration and ulceration of the inguinal lymph nodes may occur. One reported case of tuberculous ulcer was diagnosed by removal of an inguinal lymph node.[4] Tubercle bacilli may be found in the inguinal lymph glands.[5] The coexistence of erythema nodosum is also suggestive.[6]

The treatment depends not only upon the extent of the local vulval involvement, but upon the existence and extent of any extragenital tuberculosis as well. Certainly a thorough physical examination supplemented by roentgenologic studies is most essential. General hygienic measures are of paramount importance. Because of the frequency of an associated pulmonary lesion, local anesthesia is most advisable. Small lesions may be treated satisfactorily with curettage and cauterization.[7] However, the smaller lesions, and often the larger lesions, may be treated best by excision.

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A COMPARISON OF THE COLOR CHEMICAL TEST WITH THE FRIEDMAN MODIFICATION OF THE ASCHHEIM-ZONDEK TEST

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A CHEMICAL test for pregnancy based on the color reaction for pregnandiol (Guterman[2]) may eventually replace that of the Friedman modification of the Aschheim-Zondek test. The determination can be completed within two or three hours, and the results compare favorably with the Friedman modification of the Aschheim-Zondek test. The chemical test has the distinct advantage over the Friedman test in not requiring rabbits, in being quicker and less expensive.

Method

In our laboratory, we have been carrying out the chemical color reaction test for pregnandiol simultaneously with the Friedman test for pregnancy. The color reaction test is based upon the method for pregnandiol extraction by Astwood and Jones[1] and the color reaction of Talbot and his associates,[3] which has been modified by Guterman[2] for the purpose of ascertaining pregnancy. The method consists essentially of the extraction with toluene of the acid-hydrolyzed pregnandiol complex of urine, followed by the purification and precipitation of the pregnandiol. The characteristic color is developed by sulfuric acid.

The technique of Guterman[2] is as follows:

A. Hydrolysis and extraction of pregnandiol:

1. One hundred cubic centimeters of urine, 50 c.c. toluene, chemically pure, 10 c.c. concentrated hydrochloric acid, and 2 glass beads are added to a 500 c.c. flat-bottomed Florence flask.
2. The flask is connected via a one-holed cork stopper to a vertical Liebig condenser and the mixture is boiled vigorously over an electric hot-plate for fifteen minutes.
3. The flask and its contents are brought to room temperature by cooling under the water tap.
4. The mixture is transferred to a 500 c.c. separatory funnel, and the lower layer is drawn off.
5. The toluene layer and the toluene-water emulsion are washed twice with 15 c.c. portions of 0.1 N sodium hydroxide and then twice with 15 c.c. portions of distilled water.

B. Precipitation of impurities:

1. The washed toluene and toluene-water emulsion (A-5) are transferred to a 125 c.c. Erlenmeyer flask.
2. The mixture is boiled over an electric hot-plate (in the hood).
3. When the water has evaporated and the toluene mixture is boiling smoothly, 10 c.c. of 2 per cent sodium hydroxide in absolute methanol are added.

4. The mixture is evaporated until one-half of the original toluene volume is reached.
5. The toluene mixture is then filtered, while hot, through a fritted glass filter (medium porosity Pyrex) with mild suction. (If the filtrate has an orange, pink, or brown tinge, steps B-3, B-4, and B-5 must be repeated until the filtrate is yellow or yellow green.)
6. The precipitate (B-5) is washed with 15 c.c. hot toluene.
7. The combined filtrates (B-5 and B-6) are then evaporated to dryness over the hot-plate (in the hood), a gentle air stream being used to drive off the last traces of toluene. This avoids charring of the residue.

C. Precipitation of pregnandiol:

1. Five cubic centimeters of acetone are added to the residue (B-7), and the mixture is warmed over a hot-plate until the solution is complete.
2. Twenty cubic centimeters of 0.1 N sodium hydroxide are added slowly while the mixture is still on the hot-plate.
3. The flask is then placed in an ice-water bath for thirty minutes or in a refrigerator for one hour.

D. Isolation of pregnandiol:

1. The mixture (C-3) is filtered through a fritted glass filter.
2. The precipitate (D-1) is washed with 15 c.c. distilled water.
3. The receiving flask is changed, and 10 c.c. hot absolute alcohol is passed through the fritted glass filter to dissolve the precipitate.
4. The alcohol filtrate (D-3) is evaporated to dryness over an electric hot plate.

E. Color development:

1. Ten cubic centimeters of concentrated sulfuric acid are added to the residue (D-4), and the color is observed in a test tube when solution is complete. Colorless to light yellow solution is read as negative. Orange to deep orange brown is read as positive.

We have made a few minor changes in the above technique so that it is never necessary to refilter the toluene mixture containing the impurities, as the filtrate is always yellow in color (B-5). We also find that in using an egg-shaped porcelain crucible, Coors No. 2, that the mixture will evaporate to dryness without charring (B-7).

The technical differences, as compared to the technique of Guterman,[2] are as follows:

A-4. Allow the toluene layer and toluene-water emulsion to stand until no more urine can possibly be drawn off.

A-5. If the mixture should turn blue litmus paper red after the second addition of alkali, repeat. Then, if the solution is not clear, centrifuge. The clear solution will appear at the top of the tube. After each addition of alkali and distilled water, shake for two or three minutes, preferably in a shaker.

B-1. Transfer to 125 c.c. Erlenmeyer flask the washed toluene and toluene-water emulsion; then pour the supernatant into a similar flask.

B-4. The solution is evaporated until approximately one-half of the original toluene volume is reached.

After the addition of the sodium hydroxide in methanol, the solution becomes cloudy. When precipitation of the impurities is complete, the solution suddenly bubbles up; then boils smoothly. Allow the solution to continue boiling until approximately one-half of this volume has evaporated, before removing from the hot-plate.

Results

The chemical color reaction test for pregnandiol has been done simultaneously with the Friedman test for pregnancy on 304 patients. Of this number, 262 tests were in perfect agreement: 130 tests showed positive results for both pregnancy tests, and 132 tests showed negative results for both. These findings were borne out by subsequent clinical findings. The results on the other patients did not coincide. Negative chemical tests and positive Friedman tests were obtained on 30 patients diagnosed as threatened abortion. From this group, 22 aborted; 10, however, were given progesterone, and several months later, 8 of the patients were still pregnant. All persons were hospitalized on account of much bleeding. Two patients gave positive results for both tests; then suddenly aborted the following day. There had been no bleeding prior to abortion.

Two patients, we believe, had a persistent corpus luteum cyst that finally degenerated. We did a series of tests, each time obtaining positive chemical and negative rabbit results. After two months, amenorrhea ceased, and a few days later the pregnandiol titer dropped, finally reaching the negative level.

Two cases of hydatid mole were tested. In both instances the chemical test was negative; the rabbit results, positive.

In eight cases, pregnancy was indicated chemically two or three days before it showed biologically. The chemical results were read incorrectly in ten cases.

The table below summarizes the results:

TABLE I

	CHEMICAL TEST		FRIEDMAN TEST	
	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
*Normal pregnancy	121		121	
Ectopic pregnancy	9		9	
Not pregnant		132		132
Threatened abortion		30	30	
Corpus luteum cyst	2			2
Hydatid mole		2	2	

*Eight from this group gave positive chemical results two or three days before the results were positive biologically.

Discussion and Conclusion

The results which were obtained leave no doubt that there is an equivalent degree of accuracy between the chemical color reaction test and the Friedman test for pregnancy. The chemical test has the advantage over the Friedman test in that a result can be obtained within two or three hours, and that it is more economical. The chemical test plus the Friedman test are good indicators in cases of threatened abortion. The chemical test is negative in threatened abortion due to the fact that there is little or no progesterone being produced. This decrease or lack of progesterone, no doubt, is the cause of the threatening abortion. In contrast, the Friedman test depends upon the anterior-pituitary-like substance elaborated by chorionic villi. A positive

chemical test will be obtained in cases of a corpus luteum cyst but, since such cases are not too numerous and can be differentiated from normal pregnancy by the Friedman test, it should not be a disturbing factor.

I wish to express my appreciation to Dr. C. Arthur Elden for his friendly help and criticism of this work.

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A CONGENITAL ANOMALY OF THE VAGINA WITH PYOCOLPOS

DANIEL J. MCSWEENEY, M.D., F.A.C.S., BOSTON, MASS.

CONGENITAL atresia of the vagina is usually accompanied by amenorrhea or oligomenorrhea with or without hematocolpos, depending on the functioning capacity of the uterus. These abnormalities cause the patient to seek medical aid early after puberty, whereupon the anomaly is discovered and treated if possible. The following case is interesting because the patient experienced no menstrual difficulty suggestive of her abnormal condition, and also because it contributes further evidence to substantiate the dual origin of the vagina, the upper two-thirds from the müllerian system and the lower third from the urogenital sinus.

Case Report

M. E. R., aged 40 years, an unmarried secretary, entered St. Margaret's Hospital Oct. 27, 1944. (Case history No. 443527.) Measles and whooping cough in childhood. Appendectomy in 1924.

Menstrual History.—Menses began at the age of 13 years, usually lasted eight days, and were regular every twenty-eight days. There was a profuse flow for the first two days. No dysmenorrhea. No metrorrhagia. Menses began to be scanty in June, 1943, and ceased entirely Dec. 15, 1943.

Present Illness.—For ten years the patient had a vaginal discharge which varied from a watery to purulent character. It was never bloody, blood-stained, or black. For the past three weeks it was extremely foul, necessitating the patient giving up her work. During these latter ten years there were occasional attacks of lower abdominal cramps referred to as "gas pains" every two or three months and lasting three days. There was no nausea or vomiting. The bowels were regular. There were no urinary symptoms. For the past three weeks there had been rather steady lower abdominal pain mostly in the midline just above the pubis.

Temperature, pulse, and respiration were normal. Urine was negative. Red blood count, 4,600,000; hemoglobin, 90 per cent; white blood count, 10,000.

Physical examination was negative except for the local findings.

Examination under gas-oxygen Oct. 28, 1944: External genitals were normal. Hymen was normal and the hymeneal orifice admitted a finger. The vagina as felt on digital examination through the hymeneal orifice was a rudimentary closed pouch about one inch in depth and width. On speculum examination it presented a smooth, glistening, pink surface with no apparent point of entrance of a sinus. Attempts at probing for a sinus were unsuccessful. Examination through this vaginal pouch was unsatisfactory for palpation of the pelvis. Rectal examination found the uterus high and apparently normal in size, contour, and consistency. The adnexa were not palpable. Below the uterus was felt a soft, apparently cystic mass extending to the rudimentary vagina.

Diagnosis.—Congenital malformation of the vagina with pyocolpos.

Operation.—Oct. 30, 1944. Spinal anesthesia. Ureteral catheters were inserted prior to operation. A five-inch midline lower abdominal incision was made. The uterus was found to be normal in size, contour, and consistency. Both tubes and ovaries were apparently normal. Extending downward from the uterus was a sac corresponding to the vagina, definitely cystic and very thin-walled in its lower aspect. The bladder and rectum were freed well from the cervix and the vagina, and a complete hysterectomy with excision of the upper vaginal sac was performed. The base of the vaginal sac was markedly adherent

to the dome of the rudimentary lower vagina and was excised with considerable difficulty. This step was considerably facilitated by having an assistant insert one finger into the vaginal sac below and another into the rectum to keep these parts differentiated. During the excision, a small rupture occurred at a thin point in the vaginal sac and a small amount of very foul pus exuded, necessitating drainage from below and through the abdominal wound.

The convalescence was uneventful. The highest temperature was 100.6° F. on the first postoperative day. The temperature ranged from 99 to 100° F. for twenty-one days. The patient's pulse varied from 90 to 100. The patient was discharged on the twenty-fourth day after operation, and there was a continuation of the foul discharge through the lower vagina and the abdominal incision for twelve weeks.

Cultures of the exudate showed *Bacillus coli* and anaerobic *Streptococcus hemolyticus*.

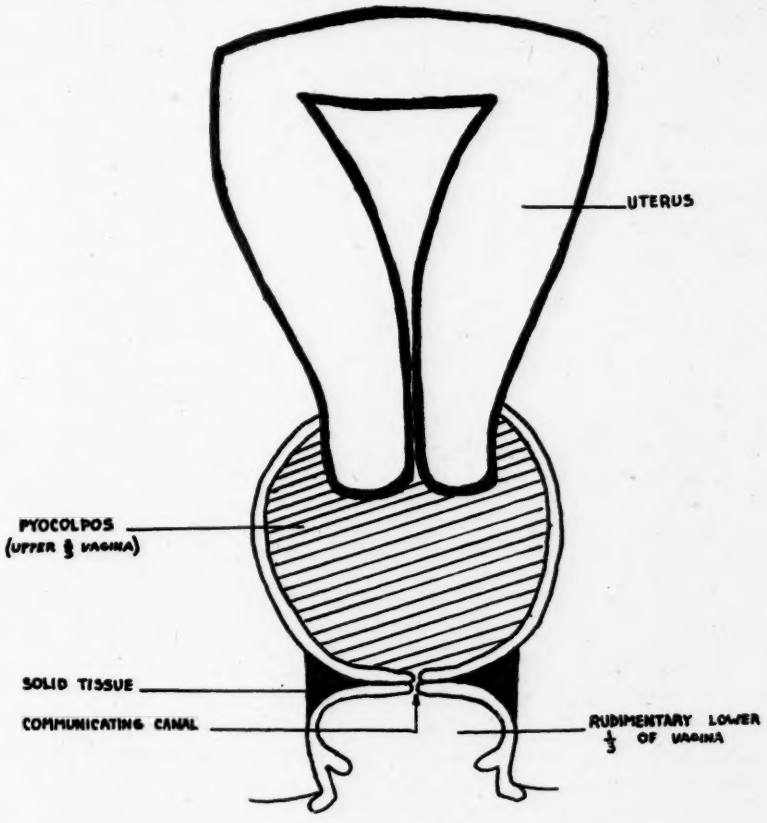

Fig. 1.

Pathologic Report.—Gross—uterus measures 8 cm. in length. Cervix surrounded by long, thin-walled vaginal sac measuring 6 cm. Body of the uterus is small measuring 4 by 3 cm. at the fundus. Uterine canal is 6 cm. long. Endometrium, endocervix, and vaginal mucosa are a peculiar greenish-gray. Myometrium is yellowish-white, firm, and 1.5 cm. thick. External os is small, everted, and shows reddening of the portio epithelium.

Microscopic—Subacute endometritis
Negative myometrium
Extreme chronic and acute cervicitis
Acute and chronic vaginitis
Pyometra
Pyocolpos

Comment

The construction of the two vaginal sacs was quite obvious proof of the dual origin of the vagina. The profuse discharge, despite the microscopic opening in the lower vagina was remarkable. The arrest of the vagina at such a late stage in its embryologic development without associated abnormalities in the rest of the female reproductive organs is interesting. When seen so late in life, the best solution seemed to be removal of the entire uterus and the infected upper sac of the vagina. If the patient had been treated earlier, drainage from below with a reconstruction operation on the vagina later could have been effected easily.

A SIMPLE, INEXPENSIVE RESUSCITATION APPARATUS FOR THE NEWBORN INFANT

EDWARD A. GRABER, M.D., NEW YORK, N. Y.

ALTHOUGH many factors are listed in all discussions of asphyxia neonatorum, none is as important or as frequent as obstruction of the passageway between the pharynx and the lung.

There is no doubt that hypnotic drugs, general anesthesia, and intracranial damage are all predisposing factors to asphyxia; they not only delay the onset of breathing by depressing the respiratory center, but also abolish the initial cough and crying reflexes which help the child clear its respiratory passages.

If the central nervous system is depressed, the airways must be cleared and artificial respiration instituted until the baby can take over this function itself.

It should be pointed out that none of the so-called respiratory stimulants have a beneficial effect on asphyxia.

Most physicians who deliver babies are well aware of the fundamental principles of infant resuscitation, to which the great majority of babies respond well. These babies, however, are only partially apneic or sluggish. They have good, regular heartbeats, only slight cyanosis, good reflexes, and make occasional attempts to breathe. The ordinary methods of stimulation give excellent results in this group. The difficult group do not respond to the above. These babies are pallid, the heartbeat is weak and irregular, the muscles are flaccid, the reflexes are absent, and the baby makes no attempt to breathe. Intubation and artificial respiration are absolutly indicated if these babies are to be saved.

Many machines have been devised to feed the baby oxygen through an intubation tube. The disadvantages of all of them are that they are expensive, are not portable, and are generally technically difficult to use.

The problem at hand was to find some method of infant resuscitation which was inexpensive, easily transportable, available in times of priorities, efficient, and yet so easy to operate that the general practitioner could use it in the small institution or in the home.

Of all the methods of resuscitation, that advocated by Flagg seems to be the most scientific. The one objection is that the average physician cannot use the direct vision laryngoscope without special training. Yet every practitioner of obstetrics, every registered midwife, every obstetrical nurse, can become familiar with the simple technique of passing a catheter down a baby's trachea. A No. 12 woven silk catheter with its opening at the end is passed along the index finger in the baby's mouth to the base of the tongue. Here the tip of the finger pulls the epiglottis forward. The catheter is pushed down and forward into the trachea. One can be certain that the catheter is in the trachea by feeling the same along the midline of the baby's neck. Once the tube is in place, it can be connected to a suction machine or with an intermediate glass bulb and tubing so that direct mouth-to-mouth suction can be instituted. Thus, the problem of clear passages can be solved.

The problem of artificial respiration with air under controlled pressure requires consideration. Mouth-to-mouth breathing or oxygen without some check on the pressure may cause serious lung damage. In order to control pressure, a very simple apparatus is suggested (Fig. 1). It consists of a series of pieces of rubber tubing connected by two T tubes, and a glass tube 14 to 16 inches long. It can be assembled in any hospital laboratory. The glass tube immersed in 12 inches of water acts as a safety valve. When the pressure of the phy-

sician's breath or the oxygen is greater than 12 inches of water, it will automatically blow off through the water. To make alternate pressure, the finger is put over the open end of the distal T tube at the rate of 16 to 18 times per minute. This forces the oxygen into the tracheal catheter and then to the lungs under controlled pressure. The rate and rhythm should be modified by the physician as soon as the baby makes any attempt to breathe. The newly established rhythm must be followed or the respiratory effort will be depressed.

The above described apparatus costs less than two dollars, exclusive of the oxygen. It can be set up permanently in the delivery room, or can be wrapped in a small package and carried to the home. In the home it can best be used for direct mouth-to-mouth insufflation.

As far as the water receptacle is concerned, a 1,000 c.c. graduated cylinder is advocated, but in the home any vessel more than 12 inches high can be used. The top must be open for the escape of air.

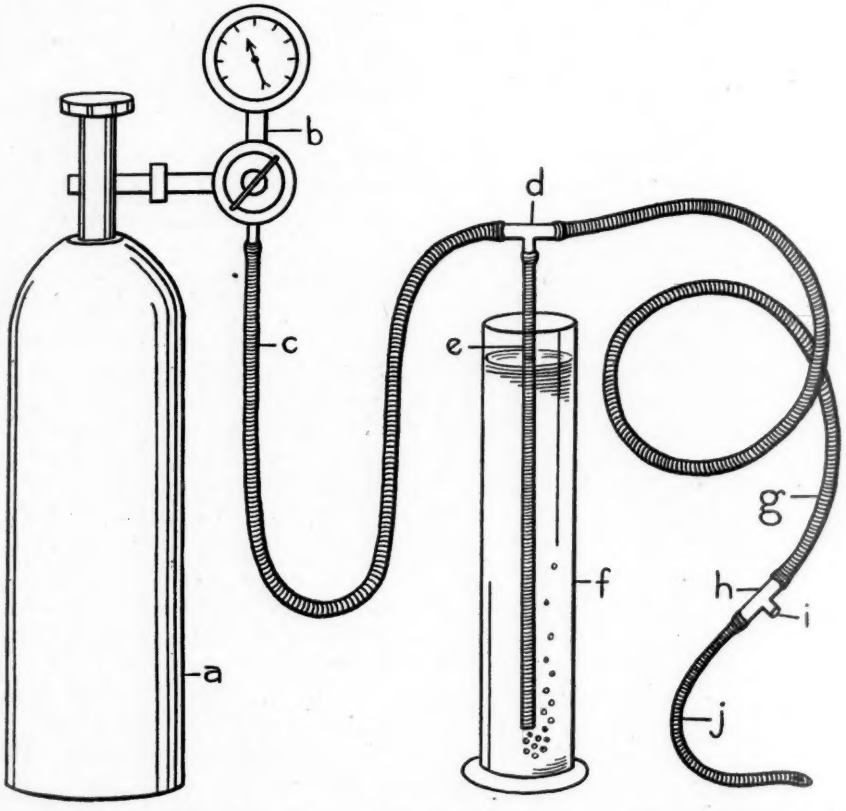

Fig. 1.—*A*, Oxygen cylinder; *B*, oxygen regulator; *C*, length of rubber tubing; *D*, T tube; *E*, glass tube; *F*, water container; *G*, length of rubber tubing; *H*, T tube; *I*, open end of T tube for finger control of inflow of oxygen into tracheal catheter; *J*, tracheal catheter.

After the baby has established its normal respiration, it may be desirable to give it continuous oxygen for a time to stimulate the respiratory center. The catheter can be withdrawn from the trachea, left in the mouth, and if the opening of the distal T tube is closed with adhesive tape, the baby can get continuous oxygen at the controlled pressure of 12 inches of water.

In the average baby with asphyxia, the apparatus described above has worked well. Its simplicity is such that it can readily be adopted by any practitioner who will take the time to study the diagram and master the technique of tracheal intubation.

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EXCRETION OF PENICILLIN IN HUMAN MILK FOLLOWING PARTURITION*

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RECENT reports by Bryan and his associates[1] and by Seeley et al.[2] have indicated that penicillin is not excreted into bovine milk following intravenous administration. Hodgkinson and Nelson,[3] however, recently reported that twenty-four cases of acute puerperal mastitis had been treated successfully with penicillin administered by the intramuscular route. The present investigation was undertaken to determine the amount of penicillin excreted in human milk.

Experimental.—Eleven normal patients seen during the past nine months were selected for study. Penicillin, dissolved in sterile saline, was administered by the intramuscular route two to five days following delivery. Samples of blood were taken for assay one to two hours after the last dose of penicillin. At the same time the breasts were pumped, and milk samples were taken aseptically.

In each case the blood was allowed to clot and the serum was withdrawn with sterile precautions. Serum and milk were stored at refrigerator temperature and assayed for penicillin within twenty-four hours. The method of Dawson, Hobby, et al.[4-6] was used throughout. Blood levels ranged from 0.112 to 1.92 units per c.c. Penicillin was present in small amounts (0.015 to 0.06 unit per c.c.) in eight of the eleven milk samples. Slightly higher milk levels resulted from the administration of 100,000 units of penicillin every two hours for a period of six hours than from a single injection of 100,000 units (Table I).

TABLE I. AMOUNT OF PENICILLIN IN SERUM AND MILK FOLLOWING INTRAMUSCULAR ADMINISTRATION

CASES	DOSAGE	SERUM U./C.C.	MILK U./C.C.
1. L. B.	100,000 U. q. 2 h. for 6 hr.	0.46	0.06
2. V. H.	100,000 U. q. 2 h. for 6 hr.	0.96	0.03
3. D. L.	100,000 U. q. 2 h. for 6 hr.	0.96	0.06
4. C. S.	100,000 U.	1.92	<0.03
5. R. H.	100,000 U.	0.48	<0.06
6. M. S.	100,000 U.	0.96	<0.015
7. M. S.	100,000 U.	0.48	0.03
8. R. S.	100,000 U.	0.48	0.015
9. E. B.	100,000 U.	0.48	0.015
10. E. J.	100,000 U.	0.48	0.015*
11. B. T.	50,000 U. q. 3 h. for 24 hr.	0.112	0.007

*Second sample taken four hours after administration of penicillin also showed 0.015 unit of penicillin per c.c.

Summary

Penicillin was administered intramuscularly to eleven normal patients. Three received 100,000 units every two hours for three injections, seven received a single injection of 100,000 units, and one received 50,000 units every three

*The penicillin used throughout this study was supplied through the kindness of Mr. J. L. Smith, Chas. Pfizer & Co., Brooklyn, N. Y.

hours for a period of twenty-four hours. All showed significantly high blood levels one to two hours after the last injection of penicillin. Eight of the eleven patients showed penicillin in the breast milk.

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Editorial

Studies Pointing Toward an Antitoxin for Late Pregnancy Toxemia[1]

A HIGHLY toxic euglobulin-like material in the menstrual discharge was first described by Smith and Smith in 1940.[1] Rats killed by this material show generalized vascular damage. The idea that a similar toxin might be operative in late pregnancy toxemia was promulgated by these authors some years ago,[2] primarily as a result of their studies of the metabolism of sex steroids in women. They pointed out that the local vascular pathology resulting in menstruation is entirely similar to the generalized vascular damage in late pregnancy toxemia and, furthermore, that their quantitative studies of the urinary metabolites of estrogen and progestin revealed an identical situation at the onset of both menstruation and toxemia, namely, a shift in estrogen metabolism accountable to withdrawal of estrogen and progesterone. Since the same hormonal changes normally precede labor and delivery, they concluded that pre-eclampsia and eclampsia are related to premature deficiency of the placental steroid hormones. Formation of the menstrual toxin is dependent upon hormone deprivation. Withdrawal of hormonal support in pregnancy would theoretically result in the elaboration of a similar toxic component, presumably in the decidua. The onset of labor may well be, at least in part, accountable to this factor. They have found the same hormonal picture in premature delivery. When, as in pre-eclampsia and eclampsia, this occurs prematurely but fails to be accompanied by delivery of the products of conception, sufficient absorption of the toxin might be expected to account for the eclamptic syndrome.

Recently the Smiths have demonstrated marked fibrinolytic activity in the euglobulin fraction of menstrual discharge and have suggested that menstrual toxin, obviously a product of intrauterine tissue damage, may be an intermediary product of the action of a proteolytic enzyme whose release depends upon cellular injury. The venous serum of menstruating and toxemic women has been shown to have the same fibrinolytic activity as that shown by menstrual discharge, whereas similar tests with the serum of nonmenstruating and normally pregnant women were negative. The identity of menstrual toxin with Menkin's more recently described injury factor from canine pleural exudate (termed "necrosin") has been established by means of cross precipitin tests with the serum of immunized rabbits. This finding indicates that the toxin may be elaborated as a result of cellular damage from causes other than hormonal deprivation. It has also provided a means of establishing the presence of menstrual toxin in the circulating blood of toxemic as well as menstruating women, thereby strengthening the original hypothesis that such a toxin is indeed operative in pre-eclampsia and eclampsia.

The venous serum of menstruating and toxemic patients differs from that of nonmenstruating and normally pregnant women and resembles the menstrual discharge not only in that it is fibrinolytic and precipitates the serum of "necrosin" immune rabbits, but also in that it contains a factor capable of prolonging the survival time of rats given a minimal lethal dose of menstrual toxin. This protective factor is concentrated in the pseudoglobulin fraction. Pseudoglobulin fractions of human pleural exudates have been found particularly potent, frequently affording complete protection. Further fractionation and purification of the venous blood of menstruating women and of human exudates is now being performed by Smith and Smith in an effort to localize and concentrate this factor for therapeutic trials. If all elemetns of danger can be removed, it should provide ideal definitive therapy for combating the toxic component which their studies so strongly indicate is operative in pre-eclampsia and eclampsia.

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Department of Reviews and Abstracts

Selected Abstracts

The Newborn

Gordon, Harry H., and Levine, S. Z.: The Metabolic Basis for the Individualized Feeding of Infants, Premature and Full Term, J. Pediat. **25:** 464, 1944.

This paper reviews certain data derived from metabolic studies which bear directly on the practice of infant feeding. The authors discuss in detail the relation of water retention to body weight change, calcium metabolism, vitamin requirements of full-term and premature infants. Stressing the appreciation of variations and proper interpretation of their pathogenesis provide the physiologic background for proper individualization in feeding of infants, sick and well, premature and full term.

JAMES P. MARR.

Weinberger, Howard A.: Anomaly of the Peripheral Vessels in a Newborn Infant, Am. J. Dis. Child. **68:** 405, 1944.

This paper reports a microscopic anomaly in the peripheral vascular system of an infant in conjunction with a death, anatomically attributed to multiple small focal hemorrhages in association with formation of abscesses.

Consideration of the embryologic aspects led to a hypothesis of embryonal maldevelopment of the peripheral vascular tree.

JAMES P. MARR.

Wiener, A. S., Wexler, I. B., and Gamrin, E.: Hemolytic Disease of the Fetus and the Newborn Infant, Am. J. Dis. Child. **68:** 317, 1944.

Two cases of hemolytic disease of the newborn are described, in which the patients were treated by transfusions of Rh negative blood. In one case, the therapy was dramatically lifesaving, while in the second, in which the disease was apparently milder, the infant died of cholemia and kernicterus.

JAMES P. MARR.

Leach, William, and Holland, Mark: Abscesses of the Lung in a Premature Baby, Am. J. Dis. Child. **68:** 324, 1944.

The authors report such a case, in a ten-week-old premature infant born six weeks prematurely. The diagnosis was made by the signs and symptoms of pulmonary abscess and x-ray findings.

JAMES P. MARR.

Waddell, W. W., Jr., and Whitehead, Betty Willis: Neonatal Mortality Rates in Infants Receiving Prophylactic Doses of Vitamin K, South. Med. J. **38:** 349, 1945.

Hemorrhagic disease of the newborn is the result of a low blood prothrombin which may be corrected by the administration of vitamin K. The routine administration of vitamin K as a prophylaxis has eliminated hemorrhagic disease of the newborn. Previous to its use, the incidence of this disease was 0.3 per cent. Vitamin K administration to the mother previous to delivery may materially decrease the incidence of intracranial hemorrhage in the infant. From March, 1940, through December, 1943, 3,775 live infants received 3.2 mg. of synthetic vitamin K intramuscularly immediately after birth. In addi-

tion, 2,879 mothers of these same infants received vitamin K by intravenous or intramuscular injection during labor. During the years 1937 and 1938, 1,429 live infants received no vitamin K. The mortality in both groups was approximately the same. It may be concluded that the routine use of vitamin K will eliminate from the nursery hemorrhagic disease of the newborn, but, apparently, does not greatly affect the mortality rate from intracranial hemorrhage.

WILLIAM BICKERS.

Aldrich, C. A.: Physiology of the Cry of the Newborn Infant, Proceedings of the Staff Meetings of the Mayo Clinic 20: 60, 1945.

The author and his colleagues, at the Rochester Child Health Project, have been trying "to study the crying habits of newborn babies under conditions which are imposed on them in a modern hospital nursery, hoping that, with these facts as a basis, we may learn how to meet the physiologic needs of these young individuals better at a most important and critical stage of their growth." The professional group caring for the newborn babies has not been alert to the physiologic needs of these babies, and consequently have been slow in instructing mothers (parents) and others regarding these needs. The problem of the proper management of the newborn is far from solved, since it is a well-known fact that the highest mortality rate among babies occurs during the first two weeks of life. This is the first comprehensive study of this nature that has hitherto been undertaken.

HARVEY B. MATTHEWS.

Radiation

Black, W. A., and Waugh, J. M.: Successful Resection for Stricture of the Rectosigmoid and Repair of Rectovaginal Fistula Following Radium Therapy for Carcinoma of Cervix; Report of Case, Proceedings of the Staff Meetings of the Mayo Clinic 20: 87, 1945.

Sufficient irradiation to arrest or destroy cancer of the cervix may cause certain complications of contiguous structures, particularly the rectum and rectosigmoid. The incidence of such lesions is quite high, and should be constantly guarded against. They probably amount to between 5 and 7.9 per cent. The incidence of merely a transitory proctitis runs somewhere around 50 per cent, and subsides in about two months under appropriate care. The chronic or late reactions usually come on about six months after irradiation. There are two types: (1) the intrinsic, in which the reaction is limited to the walls of the rectum; and (2) the extrinsic, in which the reaction is largely in the perirectal tissues. Pathologically, the reaction, as in all irradiated tissues, consists of a fibrous proliferation of the tissues in and around the rectum. Symptoms are mild, moderate, or severe depending, of course, on the amount of irradiation damage done to the tissues. Sigmoidoscopic examination in the intrinsic type readily reveals the lesion; less so in the extreme type but, even here, is of considerable value. In the latter, digital examination reveals perirectal thickening and fixidity to varying degrees. Complications are troublesome and common, especially rectal hemorrhage and stenosis. Treatment depends on the degree of reaction. In the slight and early lesions, soothing enemas are sufficient; while in the late and extensive types, colostomy until healing occurs; or in cases of stricture, colostomy and/or resection is indicated. Rectovaginal fistulae are not uncommon; likewise vesicovaginal fistulae may occur.

The authors report a case in which colostomy was employed 12 years before admission to the clinic for deep "burn" of lower bowel and rectum. They performed a series of operations, including resection of lower part of sigmoid, rectosigmoid, and upper part of rectum with primary end-to-end anastomosis. Three months later a rectovaginal fistula was successfully closed and in four months the colostomy stoma of twelve years' standing was closed. The patient was discharged in good condition.

HARVEY B. MATTHEWS.

Sterility, Contraception

Jakob, A.: Two Cases of Surgical Treatment of Sterility, Obst. y ginec. latino-am. **2:** 632, 1944.

The author reports two successful cases of plastic operations on the tubes to overcome sterility. Combining these two cases with five previous such operations, the author concludes that at the present time tubal implantation is far from satisfactory, especially in cases of diseased tubes. However, in some cases the operation is definitely indicated.

J. P. GREENHILL.

Hamblen, E. C.: Minimal Standards for Sterility Surveys, South. Med. J. **38:** 339, 1945.

The first step in treatment of sterile matings is indoctrination of the couple with the scope, aims, time, and cost of the study. The sterility survey can be completed in three visits. The first visit is made between the third and seventh days following cessation of menstruation. At this time, a blood count, urinalysis, serology, x-ray of sella turcica, and basal metabolism are done on both the wife and husband. A gynecologic and endocrine examination is made upon the wife, and a urological study upon the husband. The examination of the seminal fluid includes a study of its physical characteristics, immediate and late motility, survival time, count, and morphology. A postcoital test on the seminal fluid is made upon the wife. A uterosalpingography is performed, the author having preference for this over the tubal insufflation techniques. The patient is instructed in the taking of basal rectal temperatures for the determination of ovulation time. The second visit requires the presence of only the wife, and is made within eighteen hours after the onset of menstruation. An endometrial biopsy is taken and studied for the presence or absence of secretory changes as an indicator of ovulation. The third visit consists of a conference in which the final diagnosis and prognosis, along with therapeutic suggestions, are made. Any tests on the wife or husband which were uncertain are repeated. Occasionally, quantative studies of the urinary gonadotropin and the urinary 17-ketosteroids are indicated. Testicular biopsy, or testicular and epididymal puncture, may be necessary in cases of aspermia.

WILLIAM BICKERS.

Abortion

McDonough, James F.: Vaginal Bleeding From Potassium Permanganate as an Abortifacient, New England J. Med. **232:** 189, 1945.

Burns of the vagina and cervix due to the use of potassium permanganate tablets as an abortifacient constitute a new and gradually increasing complication of early pregnancy in and about Boston. The author reports sixty-five such cases; only six patients were successful in producing an abortion, while twelve patients required rigid shock treatment, including blood transfusions because of cervical damage and hemorrhage.

It seems, according to the author, that an attempt should be made to educate the laity that potassium permanganate is not an abortifacient. He points out to physicians the differential diagnosis between threatened and incomplete abortion, and the hemorrhage produced by potassium permanganate.

JAMES P. MARR.

Macias De Torres, E.: Fatal Cases of Induced Abortion, Rev. españ. obst. y ginec. **1:** 32, 1944.

The author found that, in 1943, the admissions for abortion to his gynecologic clinic of the Provincial Hospital of Oviedo amounted to 17 per cent of the total, and greatly exceeded the admissions for any other individual disorder. Taking into consideration that

90 per cent of the abortions were induced, and that only a small proportion of the women with induced abortions enter the clinic, the importance of the problem becomes evident.

Among the 1,160 cases of abortion there were twenty-seven deaths (2.5 per cent). However, this figure is too low, because a number of patients in desperate condition were taken home where they probably soon died.

Twenty patients (about 70 per cent) died from sepsis due to infected placental remnants. Three types of treatment have been recommended for these cases: conservative, active, and opportunistic, which consists in waiting until the patient remains afebrile for four or six days before proceeding with emptying of the uterus. In all nonfebrile cases, or febrile cases in which there is no adnexal or peritoneal reaction, the author empties the uterus by curettage as soon as possible, and takes additional measures to avoid extension of the infective process. This treatment is evidently the best and gives more rapid results than the conservative method in nonfebrile cases. In febrile cases, the duration of the infection, the virulence of the organisms, the resistance of the patient, and other factors make the difference in mortality for cases treated actively or expectantly too small to deserve consideration, while the active treatment has at least the advantage of shortening the hospitalization in those cases which progress favorably.

Another frequent cause of death is postabortive peritonitis. The use of sulfonamides is justified in these cases; it shortens considerably slight and average cases, but is less effective in severe ones.

The author prefers puncture of the cul-de-sac of Douglas in suspected peritoneal suppuration; if it is positive he performs a posterior colpotomy with drainage. If this does not make the collection of pus accessible, he continues medical treatment until he is certain that the pus can be evacuated by another route without risk.

Three patients died from pulmonary embolism due to intrauterine use of soap water or antiseptic solution.

J. P. GREENHILL.

Frühinsholz, A.: Abortion Called "Cervical," Bull. Soc. gynéc. et d'obst. **28:** 606, 1939.

By cervical abortion, Frühinsholz refers to an abortion in which the immobilized ovum rests in the dilated cervical canal, projecting through the external os, giving to the finger the sensation of a top without the peg or of a small barrel. In a series of 63 cases previously studied, it was found that in 94 per cent of the cases the duration of the pregnancy varied from six to ten weeks. It was not observed after three months and it was more frequent in multiparas (64 per cent). Eleven of the 40 multiparas had had more than five children. In most of the cases there is perhaps excessive softening of the lower uterine segment. The uterine contractions force the ovum into the dilated isthmus as a sort of hernia. The so-called cervical abortions are in reality cervico-isthmic or cervico-segmentary abortions. Since by the time the ovum reaches the cervix, the abortion has been accomplished, there is little pain, few uterine contractions, and not much bleeding. The condition is not serious. In only one in ten cases is the ovum expelled from the cervix spontaneously, hence intervention is necessary in most cases.

J. P. GREENHILL.

Malignancies

Mattos, S. O., and Menzen de Bodoy, C.: Sarcoma of the Uterus, Am. brasil. de ginec. **18:** 192, 1944.

Unlike carcinoma, sarcoma of the body of the uterus is more common than that of the cervix. Many authors ascribe this to the correlation between sarcoma and myoma. From the etiological viewpoint, sarcoma of the corpus has been grouped as follows: sarcoma developing in an otherwise normal organ (primary sarcoma) and sarcoma originating from a pre-existing myoma (secondary sarcoma or degenerated fibromyoma) the latter being by far the more frequent type. The secondary sarcomas may develop in: (1) submucous myomas, either forming a polypoid tumor with a portion of the mucosa intact, or

invading the entire mucus; (2) in subserous myomas; (3) in intramural myomas, forming circumscribed tumors, or interstitial myomas, where they are difficult to differentiate from primary sarcomas. Robert Meyer suggested the following histologic classification of sarcomas: sarcoma of the muscular cell (malignant leiomyoma, malignant myoma), fusocellular sarcoma, round-cell sarcoma, and special forms (alveolar sarcoma, angiosarcoma). The average incidence of sarcomatous degeneration of myoma, as given by statistics in the literature, is 0.76 per cent. Whereas primary sarcoma occurs usually in women past the menopause, secondary sarcoma occurs in younger women.

The clinical diagnosis of sarcoma of the uterus is difficult. The rapid growth of the tumor, presence of a sero-sanguineous discharge from the vagina with a fetid odor due to secondary infection, and emaciation of the patient should arouse suspicion of sarcomatous degeneration. Pain is an early symptom in sarcoma, ascites is often present, and fever is more frequent than in other malignant tumors of the uterus. The prognosis must be guarded because of the possibility of local recurrence. The authors favor radical operation whenever feasible. The prognosis is more favorable in circumscribed forms which are amenable to surgery and radiotherapy. The more rapidly growing tumors are of the primary type and are radioresistant.

The authors report seven cases of secondary sarcoma in women 29 to 49 years of age. One of these was considered inoperable and was given radiotherapy alone; all others were operated on and irradiated postoperatively. All the patients have been observed for one, two, and more years, and all, including the inoperable case, are in good condition.

J. P. GREENHILL.

Nomirovsky, J.: Cancer in Women and the Androgens, An. brasil. de ginec. 10: 136, 1945.

The author first discusses the value of the androgens in the prevention of spontaneous cancer in rats and the importance of castration following operation for breast cancer. On the basis of the beneficial effects observed in such cases, the author bases his rationale for the use of androgens in carcinoma in women. He reviews the literature on this subject and gives a report of eight personal cases. He confirms the analgesic effect of the male hormone and also the improvement in the patient's general condition. These effects it is true are temporary. The dose given was 25 mg. every second day.

J. P. GREENHILL.

Cohn, Theodore D., and Cohn, Harold: Low-Back Pain as Presenting Symptom of Malignant Breast Tumors, New England J. Med. 232: 342, 1945.

The prime purpose of this paper is not only to reiterate and emphasize that spinal metastasis from an unrecognized breast tumor may be the cause of chronic low-back pain.

The authors report and discuss four cases of carcinoma of the breast in which pain from metastatic foci to the spine and bony pelvis was the first evidence of neoplastic disease.

JAMES P. MARR.

Haber, J. J.: Conization and Early Diagnosis of Carcinoma of the Cervix, Am. J. Surg. 67: 68, 1945.

Conization of the cervix as a procedure combining both diagnosis and treatment is recommended by the author in cases of chronic cystic cervicitis and those where "amputation, Sturmdorff's operation, and trachelorrhaphy are indicated." It can be employed in three ways: slight, moderate, and radical, depending upon the quantity of tissue to be removed in the individual case. Among 311 conizations performed, eighteen showed malignancy, and eleven, squamous cell metaplasia on pathologic examination. It is also advocated as a routine procedure in cases in which supravaginal hysterectomy is to be carried out. As a method of biopsy, it is claimed that conization is a more thorough means of obtaining an adequate specimen.

FRANK SPIELMAN.

Cesarean Section

Habeeb, Alfred, and Elliott, Hiram R.: Cesarean Section Under Spinal Anesthesia, Southern M. J. **38**: 381, 1945.

The use of inhalation anesthesia in cesarean section practically always necessitates resuscitation of the baby. Spinal anesthesia produces marked relaxation of the abdominal wall and thereby shortens the operating time. The babies rarely require resuscitation. Operative bleeding is reduced because of the better motility of the uterus. The ideal age group for spinal anesthesia is under 30 years of age. The authors prefer the use of pontocaine in a dose of 12 to 15 mg. The spinal anesthesia is administered through the third lumbar space. Drop in blood pressure was controlled by the administration of "neosynephrin."

Contraindications for spinal anesthesia are those patients with pathology of the spinal cord, infections of the skin, septicemia, and psychic disturbances. Hemorrhage and anemia are always contraindications of spinal anesthesia.

WILLIAM BICKERS.

Orengo Diaz del Castillo, F., and Martinez Jimeno, A.: Genital Tumors as Cause for Cesarean Section, Rev. españ. obst. y ginec. **1**: 239, 1944.

Among 591 cesarean sections performed at the Santa Cristina Maternity Hospital of Madrid, the authors found eleven cases in which myoma or cyst made delivery impossible and one case in which cervical cancer was the reason for the intervention.

Myoma is rarely an obstacle to delivery. When it is, abdominal cesarean section is indicated after a cautious period of awaiting which unfolds the lower segment. The incision is made in this segment unless it contains myomatous nodules which make the classical incision advisable. Myomectomy follows if there is no infection. In suspected cases or in those with several fibromyomas, or if the woman is a multipara and near the end of her sexual life, subtotal hysterectomy is performed. Another possibility is to do only a cesarean section and leave extirpation of the tumor for a more opportune time, but this conduct is better avoided except in young women in whom enucleation of the tumor implies risks due to great difficulty of the operation or to infection. When the fetus is dead and there is infection, the uterus is removed without opening it. Total hysterectomy is not justified unless the myoma is implanted on the cervix. In the present series, cesarean section was performed in four cases, subtotal, and total hysterectomy in one case each, and myectomy in two cases. There was no maternal mortality, but two fetuses died.

Ovarian cysts offer an obstacle to delivery even less frequently than fibromyomas. The modern treatment of labor complicated by obstructing cyst is abdominal cesarean section followed by extirpation of the tumor; this was done with excellent results for mother and child in the two cases of the series. Attempts at displacement should be rejected; they cannot succeed when there are adhesions resulting from torsion of the pedicle, and this complication is frequent during pregnancy.

There was one carcinoma of the cervix which illustrates what should be done when the tumor is discovered in the third month of pregnancy; application of a moderate dose of radium (about 3,000 mg.h.), later a Porro cesarean section, and irradiation after the puerperium. The preliminary use of radium offers the advantages of inhibiting growth and extension of the tumor and of attenuating or suppresisng the infection.

J. P. GREENHILL.

Gynecology

Medina, J., Amorim, M. F., and Netto, A. Wolff: Two Cases of Brenner Tumor, An. brasil de ginec. **18**: 176, 1944.

Brenner tumors belong to the group of ovarian neoplasms designated by Greenhill as "special tumors" and to which Novak gave the generic name of "dysontogenetic tumors." Histologically, these tumors may be classified as adenocystic fibromas with Brenner type

epithelial inclusions. Depending on the predominance of the fibrous or the epithelial component, the tumors may be solid or cystic, the latter being extremely rare. With a few exceptions, Brenner tumors occur in women past the menopause. The incidence of these tumors is low. Among 48,000 ovarian tumors, Novak found 19 tumors of Brenner type, a rate of 0.039 per cent. Without microscopic examination, the solid type may be confused with fibroma of the ovary, and the cystic type, especially when the fibrous nodules are very small, with cystadenoma. The histologic characteristics of Brenner's tumor are nests of epithelial cells surrounded by fibrous connective tissue. The tumors present no special clinical symptoms other than those of a cystic or solid tumor of the ovary. Contrary to the granulosa tumors and arrhenoblastoma, they do not exhibit any endocrine activity. They are essentially benign, both clinically and histologically; they grow slowly and do not impair the general condition of the patient. Extirpation usually results in cure.

The authors present two cases of Brenner tumor of the fibrous type, in women 49 and 62, respectively, together with complete clinical histories, histopathologic findings and microphotographs. Robert Meyer's hypothesis, which considers Brenner tumors as originating from Walthard cells, is also subscribed to by the authors.

J. P. GREENHILL.

Rodrigues, F. C.: About a Case of Tuberculosis of the Cervix Uteri, An. brasil de ginec. 10: 35, 1945.

The author reports a case of tuberculosis of the cervix uteri in which the symptoms were profuse serous discharge, asthenia, pallor, and loss of weight. The patient's physician suspected a carcinoma and sent her to the author. Biopsy revealed the true diagnosis. The cervix was then amputated and the endometrium curetted. The curetted material showed tuberculosis. The operation was followed by irradiation therapy. However, pulmonary tuberculosis appeared and this was followed by involvement of the intestines and the kidneys. The patient died.

J. P. GREENHILL.

Rieper, J. P.: Auxiliary Method of Diagnosing Lesions of the Uterine Cervix, An. brasil de ginec. 10: 63, 1945.

The author recommends that vitamins A, C, and D be applied locally to the cervix in order to differentiate between benign and malignant conditions. The lesions which clear up in a few days after the application of the vitamins are definitely benign and they are in the majority. Where the cervical pathology does not disappear, a biopsy should be performed to determine the exact diagnosis.

J. P. GREENHILL.